Heating Piping & Air Conditioning

OCTOBER 1958

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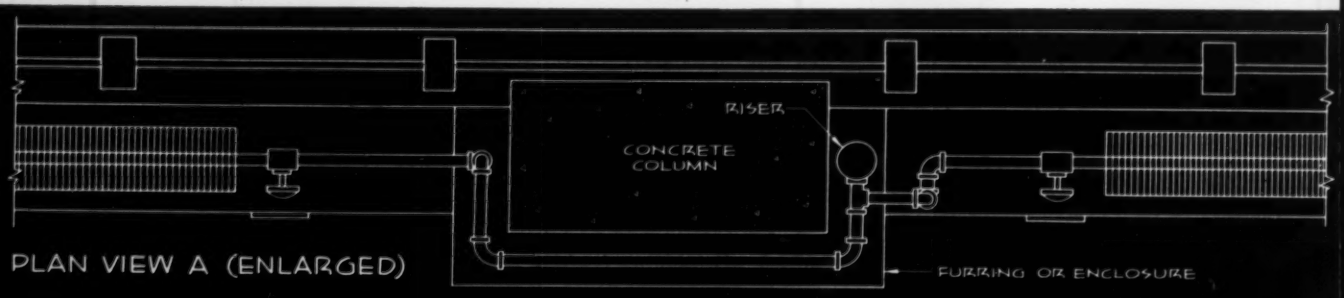
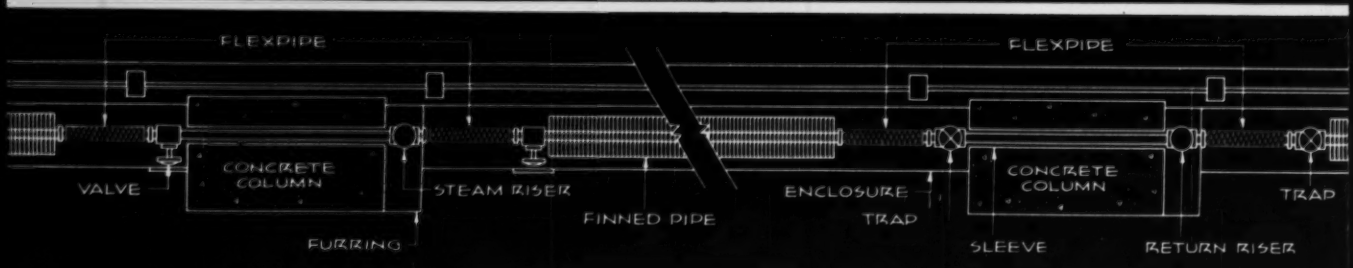
APPLICATION HINTS:

Ways to simplify construction and cut costs with Flexpipe®





PLAN VIEW B

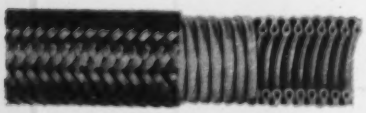
Fulton-Hempstead Building, Hempstead, N. Y. Professional Engineer: Saul Goldsmith. Air Conditioning Contractor: J. W. Hubert Corp., New York, N. Y.

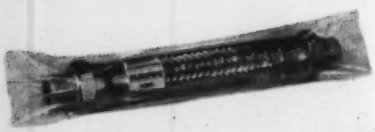
Flexpipe connectors in office building heating system reduced number of risers and furring at columns

THE PROBLEM: Structural concrete columns posed a few problems in installing finned-pipe steam radiation beneath the continuous windows in the modern 10-story Fulton-Hempstead Bldg., Hempstead, L. I. With steam and return risers located alongside the columns, there wasn't room for the usual pipe and fittings to take care of vertical and lateral expansion. The conventional practice of making these connections from the floor below in a hung ceiling was rejected as too expensive.

THE SOLUTION: The use of Flexpipe flexible connectors to take care of expansion was a natural. This approach also made it possible to reduce the number of risers by half—by connecting finned pipe in two bays to one riser. Ordinarily this would have meant piping around columns, with expensive enclosure or furring out (see Plan View A). Instead, the piping was run through the columns and connections to finned tubing made with Flexpipe (see Plan View B). This was easily done by attaching sleeves through the columns to the forms before the concrete was poured. With only one riser per column, only one side of each column had to be furred out.

WHERE TO BUY. Flexpipe connectors come in convenient standard sizes from ¼ inch through 2 inch, and are sold by leading distributors. They can show you samples and answer questions about service applications. For the name and address of the one serving your area, or for more detailed information, write to: The American Brass Company, American Metal Hose Division, Waterbury 20, Conn. In Canada: The Canadian Fairbanks-Morse Company, Ltd. 58224





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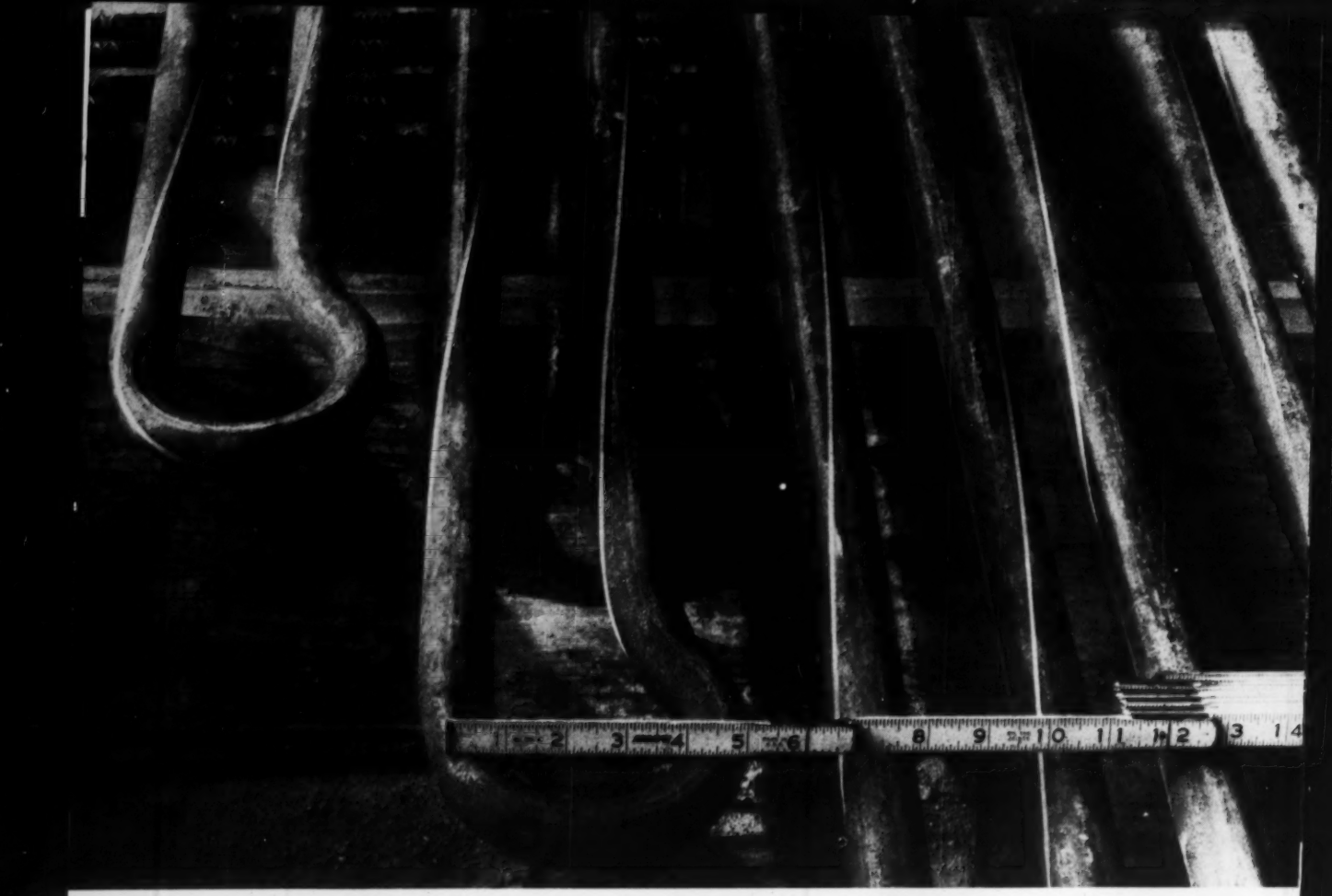
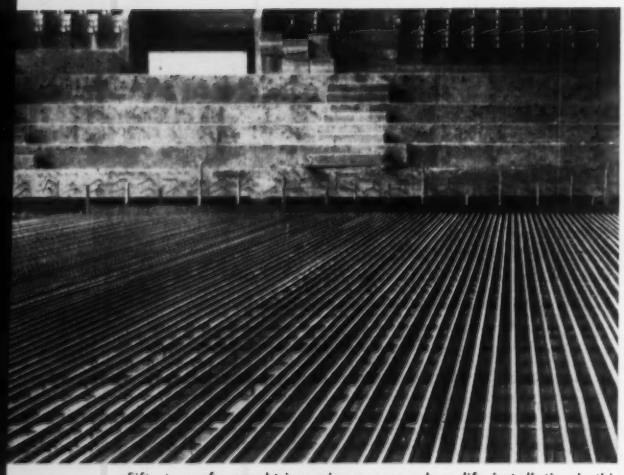


This corrosion resistant 1-inch wrought iron pipe was cold bent to 4½-inch centers.

Wrought Iron assures piping permanence at Long Island Sports Arena



Fifty tons of wrought iron pipe assure a long life installation in this indoor rink. Usable floor area totals 17,000 sq. ft.

The ice rink at Long Island Sports Arena in Commack, New York, has a built-in defense against corrosion—60,000 feet of wrought iron pipe. Extra-heavy black wrought iron pipe was used for all bends in coil installation. For straight runs, one-inch standard weight black wrought iron pipe was used.

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Long Island Arena, Thomas Lockhart, Manager
Architect: J. H. Van Alst, Centerport, L.I., New York
Contractor: Frick Company, Waynesboro, Pennsylvania

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Heating Piping & Air Conditioning

Vol. 30, No. 10

October 1958

(With which is merged the Aerologist)

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FRONT COVER: Management and its working force pool their efforts toward common goals at fifth annual UA apprentice contest and instructor training course. Shown left to right are: Horace E. Wetzell, Cleveland, MCAA president; Leon C. Hoelscher, Chicago, UA apprentice contest winner; Donald Sawyer, Detroit, apprentice runner-up; and Edward P. Geib, Milwaukee, third place winner.

Why a Steam Trap Has to Handle "Air"

Low temperatures and corrosion of equipment are often evidence of inadequate trap air venting capacity

Air, with its load of oxygen and carbon dioxide, has an unwholesome habit of interfering with the efficiency of steam heated units. If steam were always free of these undesirable companions, things would be a lot simpler for men-who-operate-plants. Because it isn't, three unhappy situations frequently occur:

1. ***Operating temperatures are subnormal.*** This is a two-part problem. First, an air-steam mixture has a lower temperature than pure steam at the same pressure—see Table A. Secondly, air can "plate out" on heat transfer surfaces as shown in Figure 1. Under some conditions, such an air film will knock down heat transfer efficiency by as much as 50%.

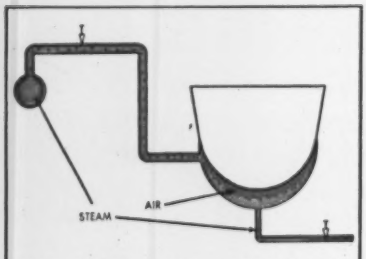


Fig. 1. *How air can "plate out" on heat transfer surfaces. This "insulation" drastically reduces heat transfer efficiency. Armstrong trap operation creates turbulence in the equipment that prevents this.*

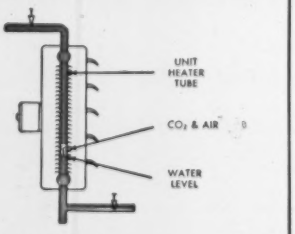


Fig. 2. *Corrosion occurs when units are not kept continuously free of both condensate and air. Armstrong traps discharge both,* at steam temperature, *as fast as they accumulate.*

2. ***Corrosion rears its ugly head.*** Oxygen and carbon dioxide are real trouble-makers. CO_2 gas goes into solution in condensate, forms carbonic acid and chews away at vulnerable metal sections. O_2 aggravates the situation. See Figure 2.

TABLE A—How air reduces steam temperature.

Gauge Pressure	Temp. of Steam with No Air Present	Temp. of Steam Mixed With Various Amounts of Air (% Air by Volume)	
		10%	30%
10.3	240.1	234.3	220.9
25.3	267.3	261.0	246.4
50.3	298.0	291.0	275.1
75.3	320.3	312.9	295.9
100.3	338.1	330.3	312.4

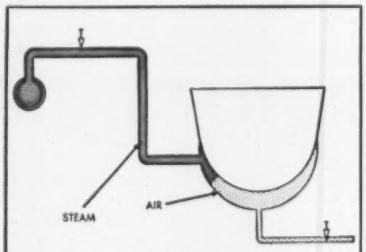


Fig. 3. *When steam is turned on, it takes a trap with extra air venting capacity to provide fast heat-up.*

3. ***Heat-up is slow as a snail.*** Air has a picnic in units that are shut off periodically. Figure 3 pictures the problem. Lines and equipment literally fill up with air. When the steam is turned on it can get in only as fast as the air gets out.

Enter Steam Traps

Curing these steam system ailments involves an operation sometimes called a "trap transplant." It consists of removing traps that don't get the air out and replacing them with traps that do.

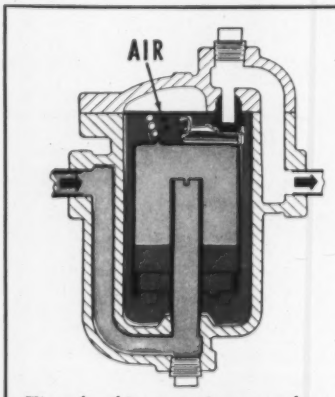
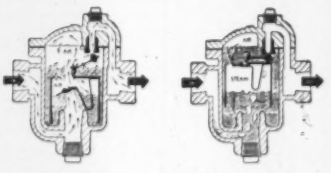


Fig. 4. *Air entering an Armstrong trap passes through the bucket vent and accumulates in the top of trap. When trap opens, air is discharged along with condensate.*

Figure 4 shows how an Armstrong inverted bucket trap continuously vents air. What the picture doesn't show is a built-in plus-value of this trap's design. An Armstrong trap opens suddenly, creating a momentary pressure drop and turbulence in the unit being drained. This breaks up air films and "pumps" air down to the trap so it can be vented.

The vents in standard Armstrong trap buckets will pass all the air normally encountered. In special cases, such as paper machine dryers, the vents are correctly sized larger at the factory to meet the requirement.



Thermostatic vent open. *Thermostatic vent closed.*

Fig. 5. *Open float with thermostatic vent for off-and-on units. When trap is cold, vent is open, permitting air to blow through when steam is turned on. When steam reaches trap, heat closes thermostatic vent. Then, regular bucket vent handles all air coming in with steam.*

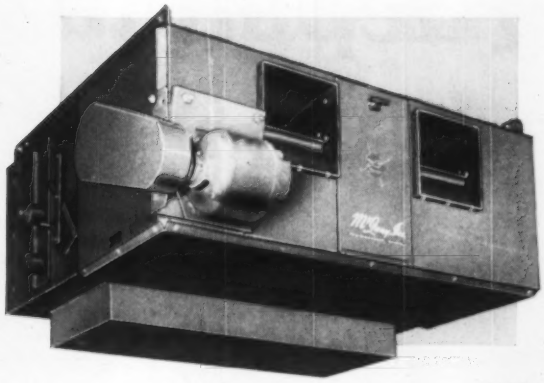
Open Float with Thermostatic Vent

Super air-venting capacity is a must for fast heat-up of low pressure unit heaters, heating coils, steam headers and other units that are on-and-off. Figure 5 shows how the Armstrong open-float-with-thermostatic-vent trap takes care of this.

* * *

The 44-page Armstrong steam trap book covers other features of the Armstrong trap as well as its excellent air handling characteristics. This catalog also discusses trap selection, installation and maintenance. Your local Armstrong Representative or Distributor will be glad to give you a copy. Call him, or write Armstrong Machine Works, 8741 Maple Street, Three Rivers, Michigan.

ARMSTRONG STEAM TRAPS



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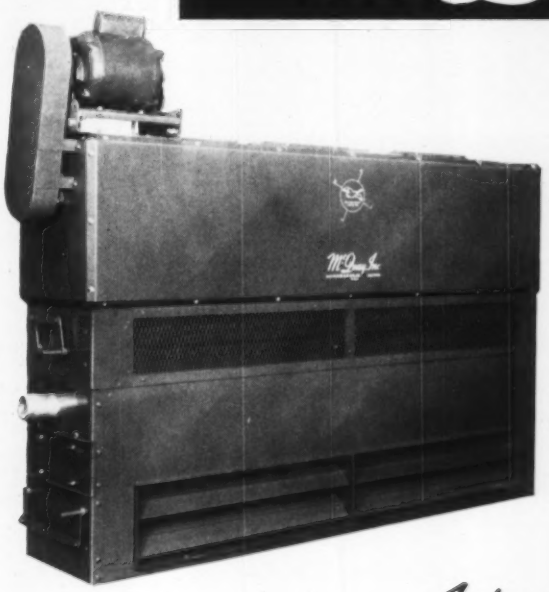

McQuay "HC" heating and ventilating units are the most flexible and versatile available for a wide range of applications, such as schools, churches, hospitals, industrial plants, public and office buildings, and other large area installations requiring quiet, high volume heating and ventilating. They'll handle even the most difficult jobs with ease. Often one McQuay unit will do what normally would require two or more other units. And with McQuay "HC" units come the exclusive Ripple Fin coils and Dura-Frame construction essential to peak performance and economy and quiet, trouble-free operation for years to come. When you have a heating and ventilating problem, call in the McQuay representative or write McQuay, Inc., 1601 Broadway Street N. E., Minneapolis 13, Minnesota.

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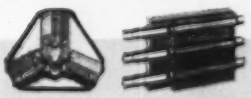

McQuay units feature the exclusive Ripple Fin coils which create maximum air turbulence and have wide, full fin collars that act as automatic spacers to form a tube around the coil tube for greatest heat transfer and protection. The Dura-Frame "V" channel construction provides the strength and rigidity necessary for quiet, trouble-free operation.

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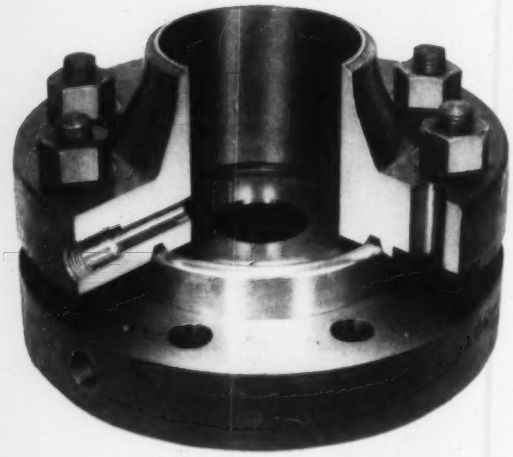

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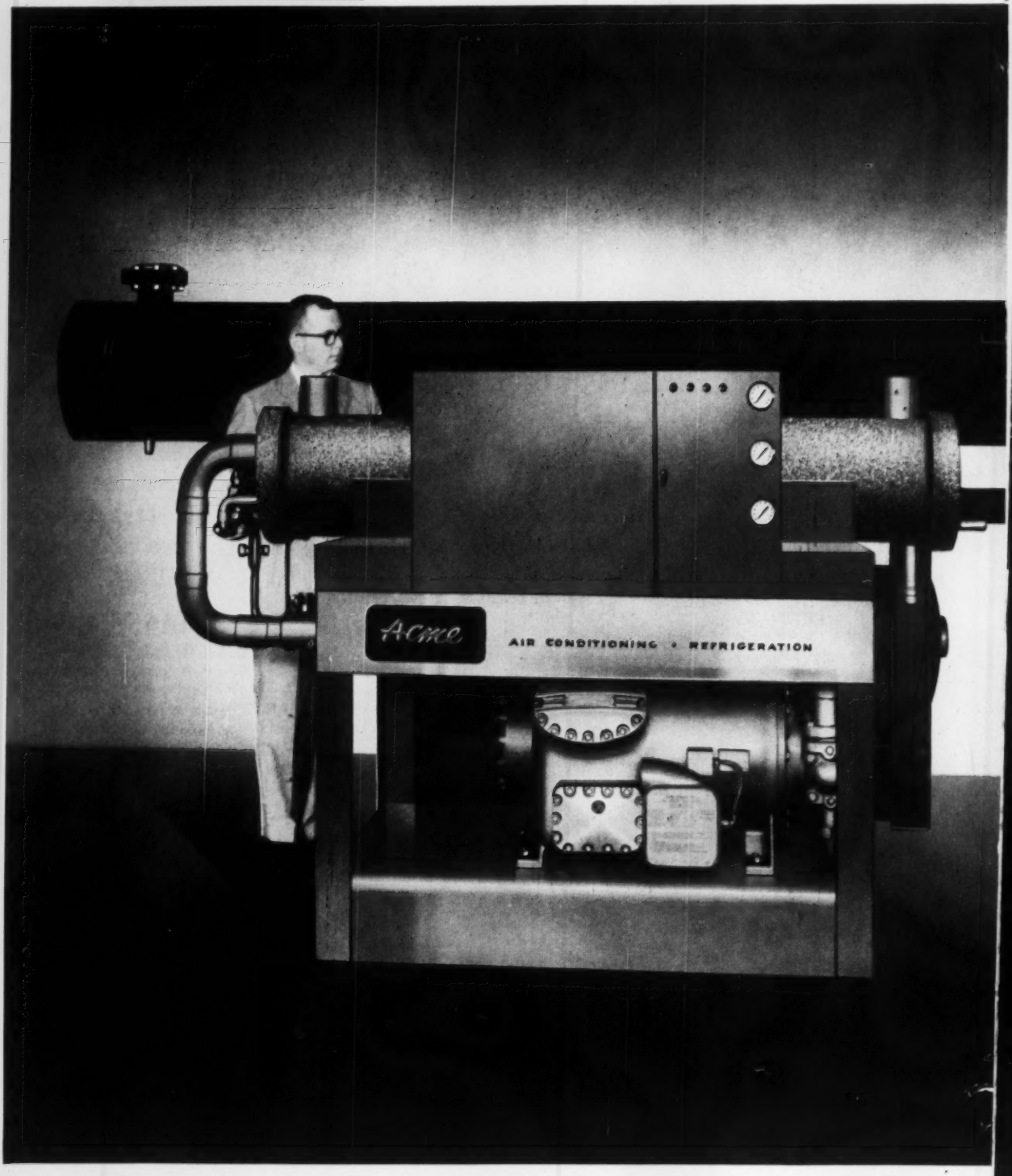

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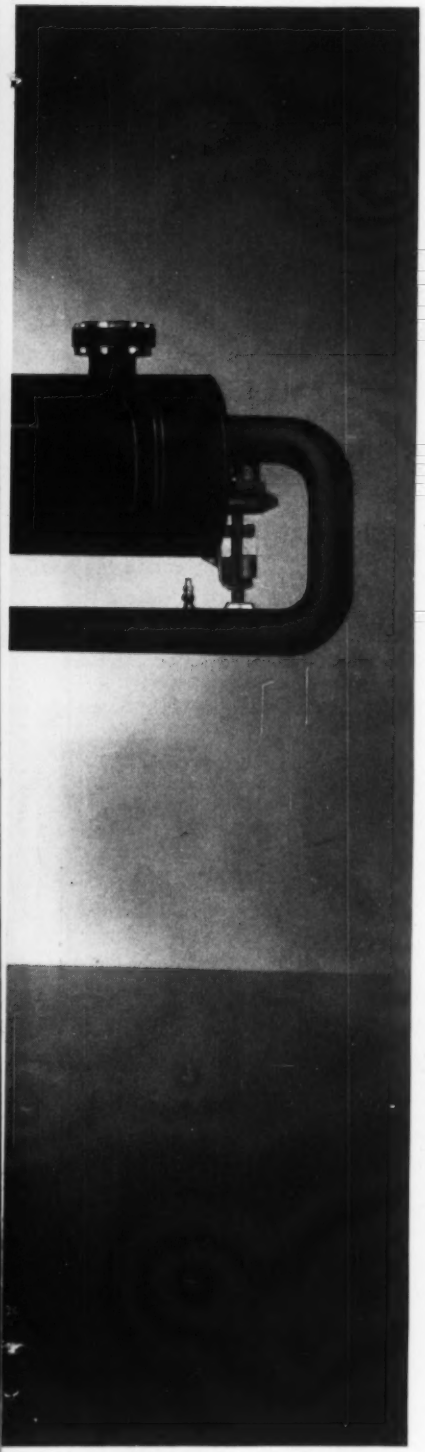

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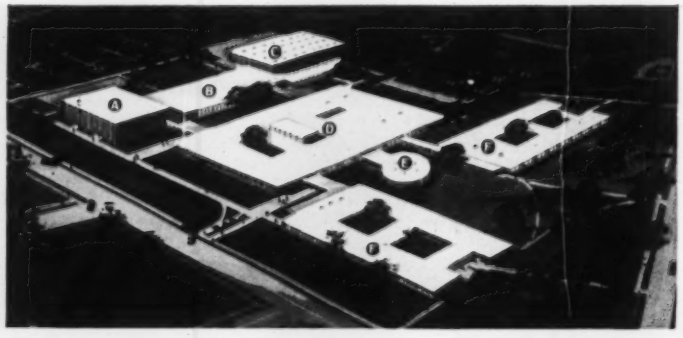

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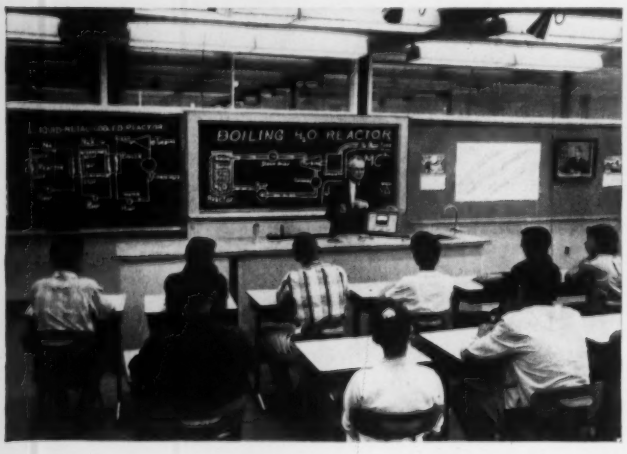

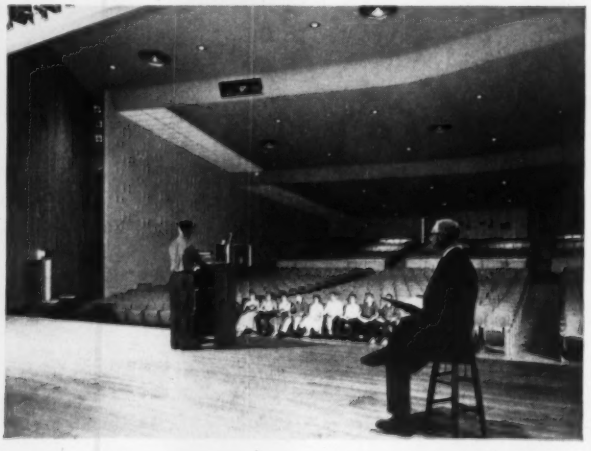

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Albany, N. Y.

"Plan a School that will still be functional in the year 2000"

. . . that was the challenge faced by the educational, architectural and engineering planners of Schenectady's much discussed Linton High School. One of the important innovations here is the year-round air conditioning in the Core-Tech building D, shown on opposite page, also the Auditiorium A, and the round Library building E.

Proper thermal environment is a valuable aid to effective teaching and learning. The flexibility of the Powers temperature control system installed at LINTON meets the demands of varied types of activity and occupancy in all seven buildings.

Air Conditioning, heating and ventilating systems are regulated from Powers Control Center located in the boiler room. See photo below at right.

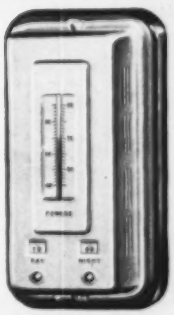
Day control for the air conditioning systems during the cooling season consists of dew point control for the chilled water coils with individual reheat mixing damper control for each zone controlled from a zone thermostat.

Night control of the air conditioning systems provides reduced room temperatures during the summer "night" cycle when the buildings are unoccupied, with a minimum of refrigeration. This feature is designed to provide precooling and reduced start-up load.

A Powers MASTROL System controls the hot water heating system plus individual room control of convectors in critical areas.

In the Year 2000, the Powers temperature control system at Linton will likely still be functional. Twenty-five to 50 years of dependable operation with a minimum of maintenance is often reported by users of Powers control.

In Your New School make sure taxpayers get the biggest return on their investment in accurate temperature control. Ask your architect or engineer to include a time-proven Powers Quality System of Control.



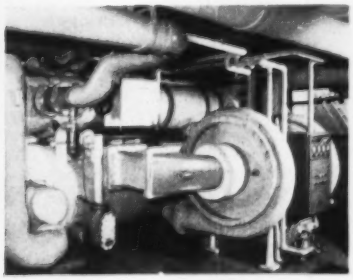
190 Powers DAY-NIGHT Thermostats here help prevent OVERheating in occupied rooms and are adjustable for lower economical temperatures during unoccupied periods.

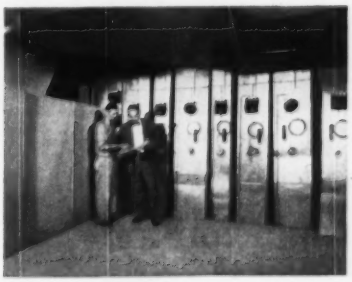
216 Powers PACKLESS Control Valves are used on convectors and unit ventilators. They're labor savers, banish packing maintenance and will prevent damage from water leakage.

THE POWERS REGULATOR COMPANY

SKOKIE, ILL. | *Offices in chief cities in U.S.A. and Canada*

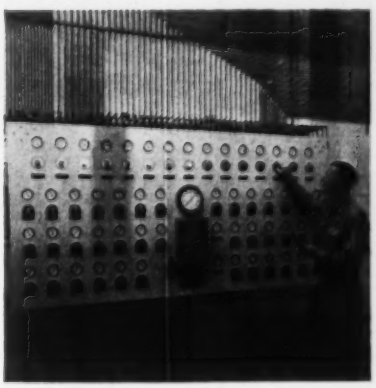
65 YEARS OF AUTOMATIC TEMPERATURE AND HUMIDITY CONTROL





Left: 235 Ton Centrifugal refrigeration compressor has ample capacity for building D and library, or auditorium alone when other two buildings are not in use.

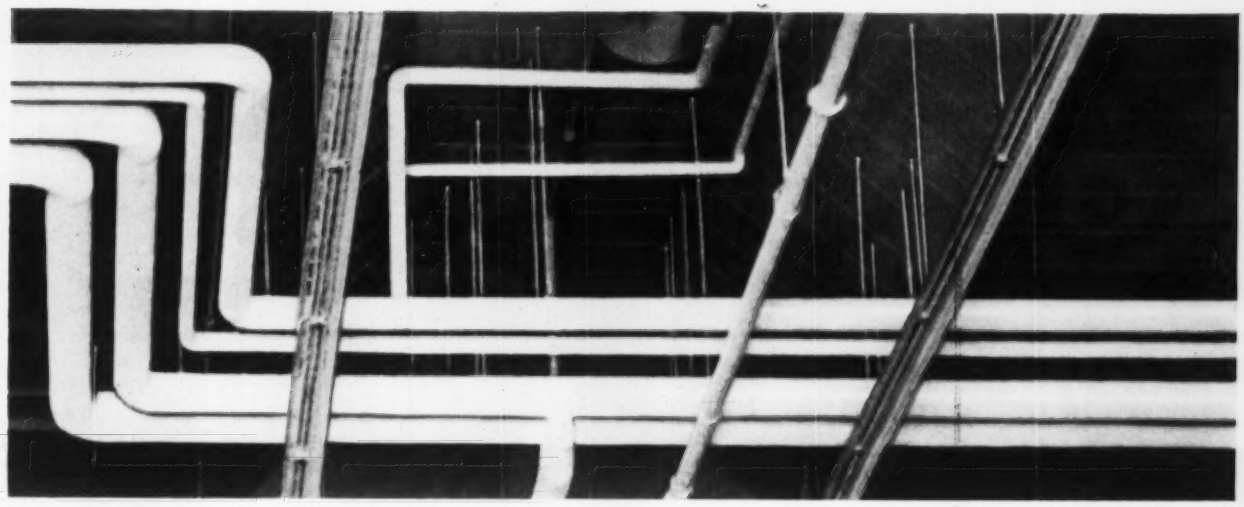
Right: Powers Control Center in boiler room. Center photo: one of 5 air conditioning systems and 9 of 68 Powers Sub-Master Thermostats controlling conditioned air to various spaces.



Improved
...*with*

One look and you know it's Fibrocel ...the only molded insulation for commercial pipelines...in attractive new VS and VB jackets.

Installs easier, faster . . . because its size and shape never vary. Butt straps go on easier, too.



JOHNS-MANVILLE ANNOUNCES . . .

Fibrocel Insulation

2 new types of white jacketing

Easier to install • More attractive • Thermally effective • Priced low for substantial savings

TEST IMPROVED new Fibrocel®—even on just a short run of pipe—and see the difference! See why this rigid, molded insulation makes an installation so many ways better!

First thing you notice about Fibrocel is that it's molded. For only an unvarying metal mold can produce such nearly perfect roundness, such uniformity of size and shape. The result—less time needed to get the neater, better fitting job you want . . . with the pipeline always dead centered in the insulation for top insulating value.

Rigidity is another Fibrocel advantage. Working with a rigid material, butt straps go on easier, faster. And your inspection (whether one day or one year after installation) reveals not a sign of denting, bulging or "fish mouthing"—so common with soft insulations.

New White Jackets

Fibrocel now comes in virtually any jacket you'll ever need. *New Type VS* is richly creped, pure white kraft backed by 1/3-mil foil. One painting provides complete coverage. Yet it's priced as low as canvas. Then, there's new *Type VB*. Priced slightly higher—but well worth it! Outer surface has same rich creping as Type VS, inner vapor barrier is full mil thickness of aluminum foil, pipe facing is creped black kraft. Creping permits surfaces to "move" with foil as moisture conditions vary. Fibrocel is also available with "Type C" canvas finish.

Let us send you a copy of IN-155A, the informative 8-page Fibrocel folder. Write for it today. Address Johns-Manville, Box 14, New York 16, New York. In Canada, Port Credit, Ontario.

JOHNS-MANVILLE

100 YEARS OF QUALITY PRODUCTS—1858 . . . 1958

JOHNS-MANVILLE JM PRODUCTS

More attractive. Rigid, dimensionally uniform, Fibrocel fits tighter, neater. Jacket doesn't dent, bulge or "fish mouth."

Insulates better. Because Fibrocel is perfectly round, pipe is always "dead center," for maximum insulating value.

Costs less. Don't let Fibrocel's appearance and efficiency mislead you. It's priced low!

Takes abuse . . . in rough service . . . keeps its "just installed" appearance through years of service.

BETTER AIR CONDITIONING FOR EVERYBODY EVERYWHERE

Carrier

Now from Carrier—a complete line of high-velocity room terminals for all-air systems

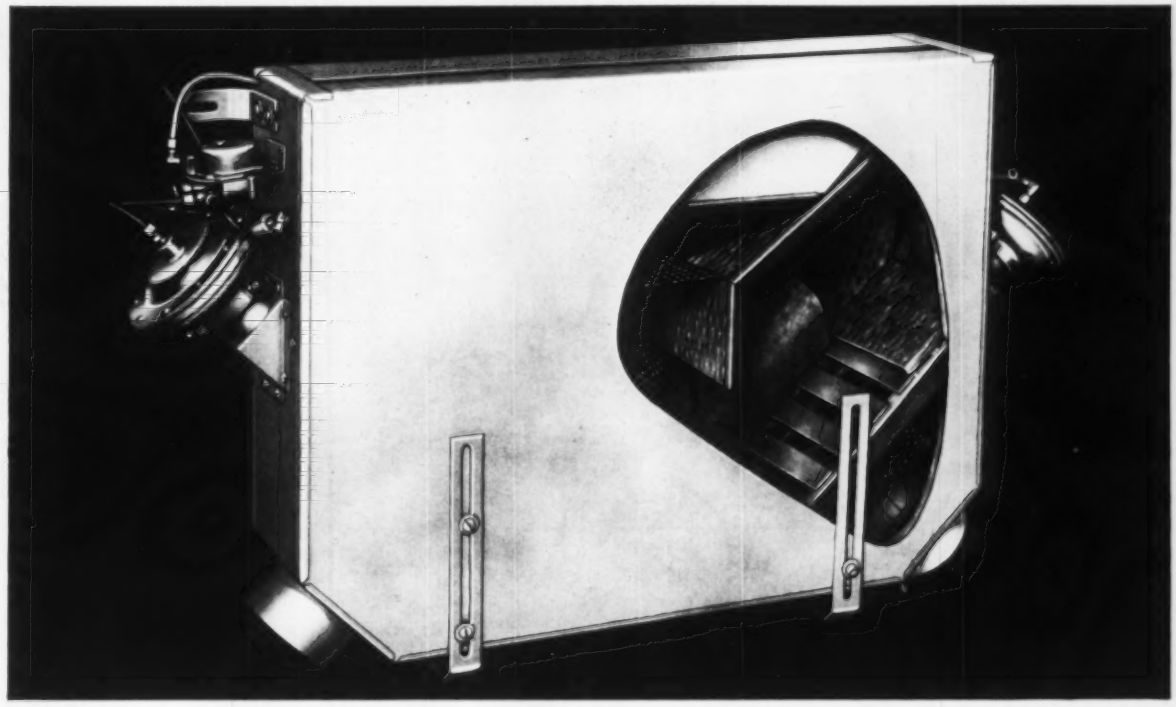
5 new models for Double Duct, Dual Conduit and Single Duct service

In its new all-air units, Carrier offers an across-the-board selection of room terminals for every type of all-air system popular today. These 37 Series Weathermaster* units provide extreme versatility of arrangement for under-window or ceiling installation both in exterior and interior zones.

Sizes from 50 cfm to 1700 cfm. These new units are available in five models, four of which are offered in six sizes from 50 cfm to 1700 cfm. The reheat model is available in three sizes only from 75 cfm to 600 cfm. The new units serve the five different types of all-air systems described on the opposite page. Outstanding features include uniform temperature and velocity over the entire discharge opening, compactness, easy servicing, quiet operation and simple controls—no linkage, no wires, no pulleys. Each model was designed specifically for one type of service.

Carrier room terminals for other major systems. The new Weathermasters round out a line of room terminals second to none for efficiency, economy and flexible application. Today only Carrier offers terminal equipment for the four major kinds of air conditioning systems in use in multi-story, multi-room buildings. Whichever system or combination of systems—all-air, all-water, air-water or refrigerant—is best for a building, Carrier has the right terminals to meet your requirements. For complete information, call the Carrier office nearest you. Or write Carrier Corporation, Syracuse 1, New York.

CARRIER 37 SERIES All-Air Weathermaster units are designed primarily for multi-room buildings such as office buildings, hotels, hospitals and schools. This cross section of the Double Duct model shows the compact mixing box, featuring spun acoustic Fiberglas, sound attenuating baffles, direct activated volume dampers and control components mounted externally for easy servicing. Uniform temperature flow across entire discharge grille—maximum temperature difference is 3% or less throughout the entire range of settings. Accessories include attractive enclosure, discharge and recirculating air grilles for furred-in applications and adapters for ceiling mounting.



Fast facts about the five new Carrier All-Air Room Terminals

1 **Double Duct:** Constant air flow; self-adjusting for varying duct pressures; easy initial air flow setting-compensator mounted on side of unit; system balancing done at unit; silent modulation of air flow from each duct.

2 **Single Duct with Reheat:** Constant air flow; adaptable for right or left hand connections; simple control arrangement; steam or hot water coils; manual positive acting damper adjustment for initial air flow setting and system balance.

3 **Single Duct, Constant Volume:** This simplest of the five models for all-air service is ideal for auditoriums, department stores or other large areas. It provides constant air flow. It's adaptable for right or left hand connections. Manual damper adjustment for initial system balance.

4 **Single Duct, Variable Volume:** Silent modulation of air flow; adaptable for right or left hand connections; simple control—only one damper motor mounted externally.

5 **Dual Conduit*:** An entirely new all-air system that provides all the functional advantages of the famous Carrier Modular Weathermaster System* but without the need for water lines. One air supply (manually adjusted constant volume, variable temperature) neutralizes transmission effects all year. The other air supply (automatically controlled variable volume, constant temperature) offsets positive heat gain caused by sun, people or heat-generating equipment.

*Reg. U. S. Pat. Off.

Know-how makes the

IN INSTALLATION AND SERVICE ENGINEERING

Dravo's new *Counterflo* is the only industrial space heater backed by a world-wide organization. The map gives you an idea of the number and location of the qualified heating engineers, sales and service offices, representatives and foreign licensees who form this global network.

This means that a *Counterflo* owner not only has outstanding heater performance, but also a highly trained, factory-schooled service organization on 24-hour call. Should the need arise, service, for both installation and maintenance, is as close as your telephone. Dravo's wide-spread field activity is supplemented by the Pittsburgh staff, who stand ready to fly to any part of the country immediately.

This is just one of the many outstanding benefits available with your new *Counterflo*. For more information, write for Bulletin 564. Address DRAVO CORPORATION, DRAVO BUILDING, PITTSBURGH 22, PA.

DRAVO

CORPORATION

difference

5 REASONS WHY THE DRAVO COUNTERFLO IS YOUR BEST SPACE HEATER BUY

NEW PYROJET BURNER—exclusively Dravo—first burner developed specifically for direct-fired space heaters. Burns low cost oils efficiently. Switches from gas to light oil automatically.

NEW INDUCED DRAFT FIRING—automatically controls fuel/combustion air ratio, high negative pressure in combustion chamber adds extra safety; extra efficiency because of complete control of combustion air.

NEW AIRFOIL COMBUSTION CHAMBER—stainless steel, ribbed for extra strength and channeling of airflow—guaranteed for 10 years. Longest possible flame travel for complete combustion within primary heat transfer area.

NEW LOW-SPEED FANS—forwardly curved, low-speed, double inlet fans with high efficiency reduce horsepower requirements in the new Counterflo drastically, operating costs are lower.

NEW DISCHARGE PLENUM—distributes heated air at high velocity without annoying drafts. Adds new flexibility to warm air distribution patterns.

A MODERN CONCEPT FOR
Heating, Ventilating and Cooling of Schools

By F. J. KURTH, Vice President
in Charge of Engineering, Anemostat Corporation of America

Educational efficiency

The Anemostat Dual Duct High Velocity System provides a controlled and healthy environment in accordance with the highest standards of comfort and is therefore conducive to more vigorous activity in the classrooms. It is a modern heating and ventilating system, carefully researched and new in concept, and is economical to install and operate. It is an effective heating and ventilating system, which later can be readily adapted to air conditioning by the addition of a central-station type refrigeration system.

Because large sums of money must be spent for new schools, it is important to study all factors which will improve educational efficiency. Though well constructed and equipped, many new schools are not provided with modern heating, ventilating or cooling systems which furnish comfort during all seasons of the year. Experience has shown that a proper climatic condition will improve student and teacher efficiency to the extent of a cumulative gain of approximately twenty percent.

System design

First the volume of air required for a classroom must be determined. In most communities this is regulated by local codes on a cubic foot per pupil basis.

Although requirements vary in different localities from ten to thirty cubic feet of fresh air per minute, there are other factors which must be considered: for ventilation purposes, when cooling is not used, a large volume of air will, of course, do a better job than a small volume; however, the introduction of from 1000 to 1200 cubic feet of air per minute is adequate. If air conditioning is installed, the engineer may specify air temperature differentials of 30° or more between the supply air in the cold duct and the room temperature—Anemostat Air Diffusers will diffuse air at high temperature differentials without draft.

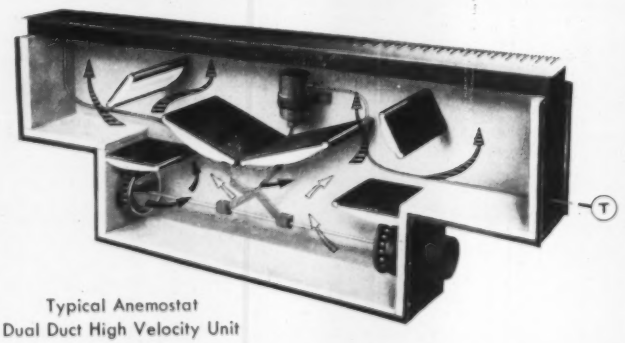
Location and type of units

The location of the units in the classroom is determined by the climate of the community in which the school is located and the construction of the school with particular reference to glass areas. When winters are severe the *under the window type units* must be used and two units per classroom should be installed as shown on the layout. The return air can be moved through corridors, ducts in corridors or exhaust plenums in the corridor ceilings.

In schools in mild climates or in colder climates where double glazing is used, the *sidewall units* will do an excellent job of year-round heating, ventilating and cooling. Two units providing from 500 to 600 CFM each per classroom are recommended. The return air can be returned to the fan through corridors, corridor ducts or plenums.

When two units are installed in a classroom, both are controlled by one

The Basic Principle of Anemostat School Units



Typical Anemostat
Dual Duct High Velocity Unit

The illustration shows a high velocity unit designed for a dual duct system for either heating and ventilating or complete air conditioning. To maintain ideal conditions, air is evenly and draftlessly diffused at high velocity throughout the classroom at controlled temperature; one duct carries cold air from the outside of the building, or cold air cooled by coils and mechanical refrigeration, the second duct carries warm air, which consists of a mixture of fresh and recirculated air heated by hot water or steam coils from heating boilers or by hot air furnaces. The thermostat in the classroom opens the hot air valve and closes the cold air valve, or vice versa depending on the room temperature requirements.

thermostat which should be located on an inside wall.

Ducts

The ducts can be installed in various ways depending on the type of structure: beneath the floor, on classroom or corridor ceilings, in roof spaces or on top of the roof. If tile or transite pipe is used the ducts can actually be buried in the ground. Because no water or steam is used, the ducts can be run in practically any space, as corrosion or trapping is not a problem.

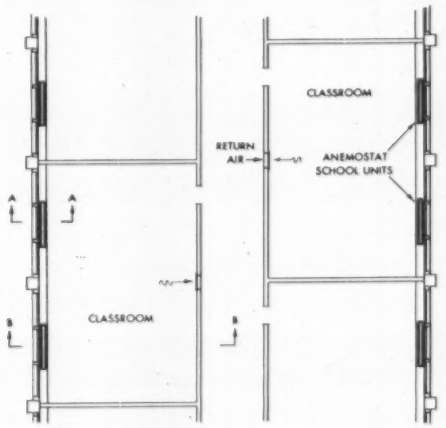
Equipment room

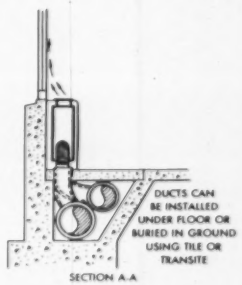
For reasons of economy, the fan room or rooms should be so located as to keep the duct runs as short as possible. However, there is no problem in running ducts long distances; dual duct systems in commercial buildings often have duct-runs of over 500 feet. The fans are usually of the Class II type and can be either the forward or backward curve type. Consideration should be given to fans of the air-foil type, which are designed for quiet operation at high pressures.

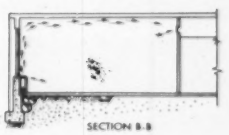
Mechanical or electrostatic filters are generally used in high class commercial buildings and should also be considered for schools. Clean, filtered air properly diffused at controlled temperature is the answer to health and comfort in classrooms.

TYPICAL CLASSROOM LAYOUTS

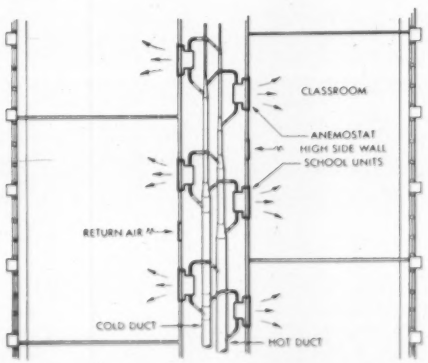
High Velocity Under the Window Units



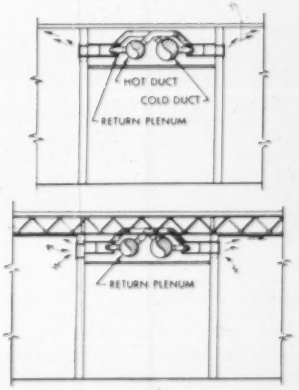




High Velocity High Sidewall Units Installed in Corridor Ceiling



Typical Sections Showing High Sidewall Type of Installation



AC-1382

Advantages of the Anemostat Dual Duct High Velocity System

The Anemostat dual duct high velocity air distribution system for heating, ventilating and cooling is ideal for all types of classrooms from kindergarten through college. It offers many important architectural and engineering advantages:

1. *Low First Cost*
2. *Low Maintenance Costs*
3. *Draftless Air Distribution*
4. *Eliminates Window Down Drafts*
5. *Scientific Temperature Control*
6. *Easily Adapted to Future Air Conditioning*
7. *Quiet Operation*
8. *Rugged Construction*
9. *Meets All Code Requirements*
10. *Pressure Balanced*
11. *Meets Modern Architectural Design*

New Anemostat School Catalog

contains complete data on Anemostat Dual Duct High Velocity Units. Write for your copy to

Anemostat Corporation of America

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"Genetron" Refrigerants are the ultimate in dryness. In "Genetron" 12, for example, there is less than one-thousandth of one percent of moisture! And the tight specifications for "Genetrons" are consistently *bettered* in production. That's why smart service engineers everywhere are insisting on Super-Dry "Genetrons."

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- Available everywhere, from refrigeration wholesalers throughout the country.

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Trichloromonofluoromethane

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GENETRON 22 GREEN LABEL $CHClF_2$
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GENETRON 113 PURPLE LABEL $C_2Cl_3F_3$
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This triumph of aerodynamic design actually creates an unfailing circulation of air without any mechanical aids of any kind! You must see an installation to believe it!

Recent installation of Colt CO/2046 Clear-opening Adjustable Louver Ventilators at BINER-ELLISON MACHINERY CO., LOS ANGELES.

40,000 INSTALLATIONS AROUND THE WORLD PROVE COLT BREAKS THE "HEAT BARRIER"

No matter what the climate, COLT's practical application of exact scientific principles vents heated process air with efficiency equal to mechanical systems, but with no motors or running costs. COLT is a profitable morale-booster that can be installed quickly without structural changes in your plant. Write for estimate TODAY.

COLT "CO/2046" CLEAR-OPENING VENTILATORS

- 7 times lighter than comparable galvanized units! Just 23 pounds each, can be installed in any type of factory roof
- Gives unrestricted passage to air, immediate release of concentrated process heat
- Removes heat from source before it can spread throughout plant
- Permits loss to atmosphere of building and body heat where this radiant heat, being of low frequency, could not normally pass through walls and roof
- Built-in hand-operated control . . . no power required
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- Unique top and side drain channels on louvers guard against rain
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McDowell & Craig, *Norwalk*
Nardon Manufacturing Co., *Alhambra*
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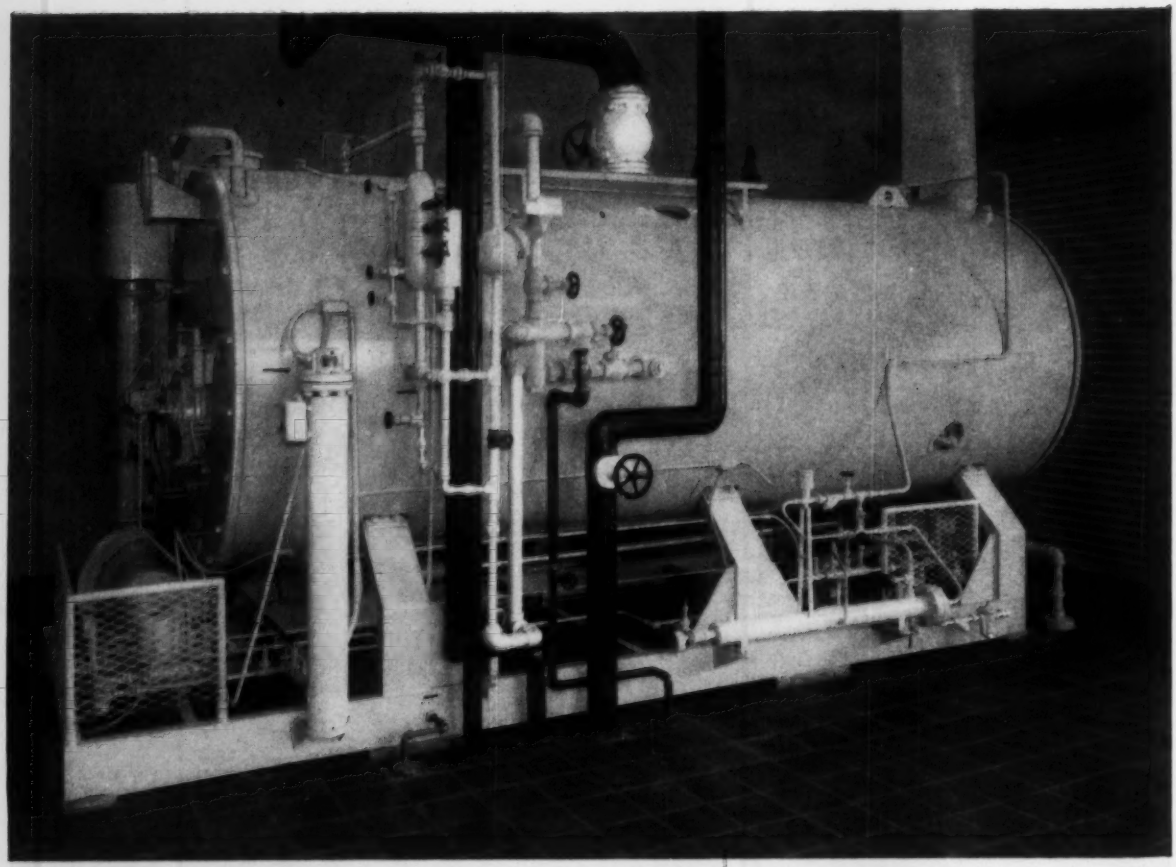

200 HP AMESTEAM GENERATOR Installation at U. S. Concrete Pipe Co.

LOW COST STEAM DELIVERED BY AMESTEAM GENERATORS

BRINGS REPEAT ORDERS FROM U. S. CONCRETE PIPE

Why is it that AMESTEAM GENERATOR customers are almost always *repeat* customers? The reason can be summed up in these words: "Lower Cost Steam". One of these repeat customers is U. S. Concrete Pipe Co., Relay, Md. This firm is one of the leading producers of large concrete drainage pipe and allied products.

Recently the company needed a boiler to supply steam for the structural curing of various concrete products. Successful experience with the AMESTEAM GENERATOR "Package" Boilers proved elsewhere in other plant operations led to selection of the 200 HP unit shown above. U. S. Concrete Pipe found that this AMESTEAM GENERATOR provides the most economical and efficient solution to this important steam problem.

Here is another of the hundreds of users whose complete satisfaction with AMESTEAM's low-cost, dependable performance is indicated by the repeat orders we continue to receive from them. This record for repeat orders is based on AMESTEAM GENERATOR's reputation for *Low Cost Steam*, faithfully delivered over a long period of years.

What's YOUR Steam Problem?

If you need 10 to 600 HP and want the kind of space-saving, trouble-free service enjoyed by satisfied owners of AMESTEAM GENERATORS, write today for our catalog and the name of your nearby Amesteam Dealer.

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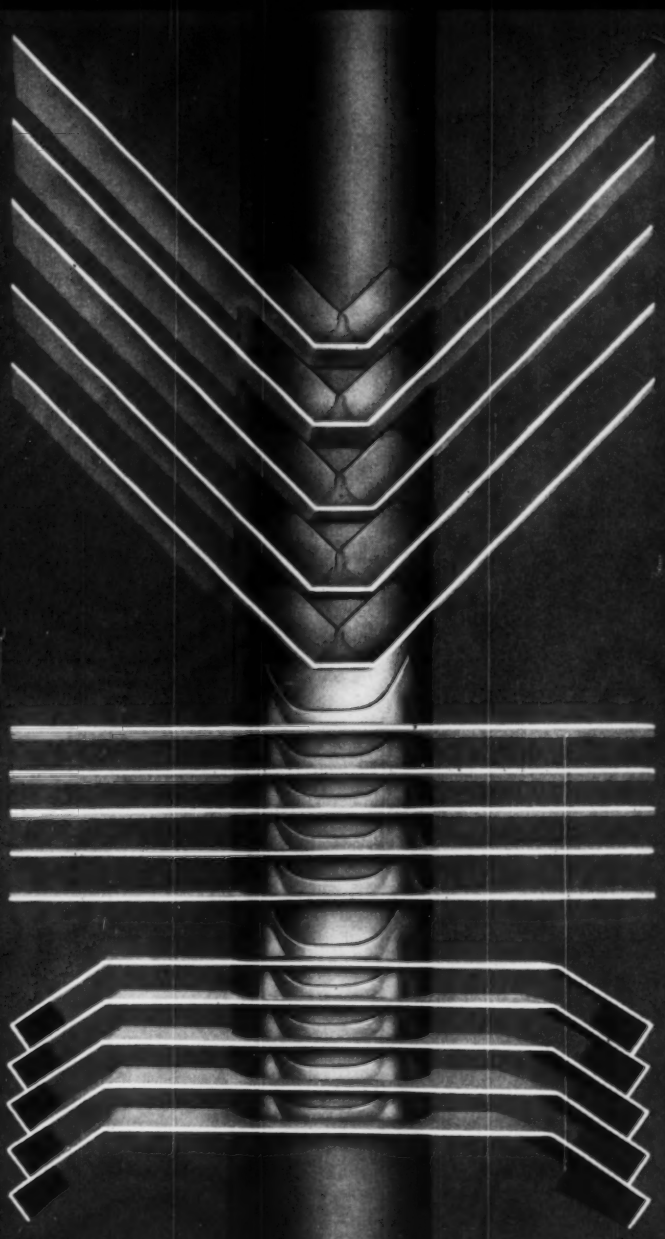

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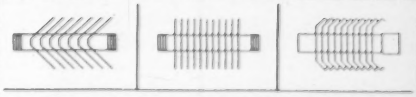
THE PROFILES: ■ THE V-SHAPE; Slant/Fin's patented processes* make possible the use of stainless steel and other heavy metal fins with full weight and extra heavy pipe. ■ THE "SQ" SERIES; Even conventional square finned elements include a Slant/Fin extra. Unique tooth-and-bubble construction, assures positive alignment and stronger thermal bond. ■ THE MODIFIED-V; Fin-touch-fin construction permits use of light gauge fin material while maintaining maximum mechanical strength. And it's also the first element in heating history free of fin vibration noise! **THE PRINCIPLE:** Every Slant/Fin product is design-engineered to fully exploit the structural and physical properties of the materials used... to measure up to the most demanding specifications in the industry. **THE PARTICULARS:** Learn how you can specify a product of uncompromising quality at a price that's competitive with any in the industry. Fill in and mail this coupon... in return receive the 1958 Slant/Fin Catalog of Commercial and Residential Heating. It tells all.

*PATENT NO. 2620171 AND OTHER PATENTS PENDING.



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B. F. Goodrich does big job at world's biggest hotel

"When asked to equip 3200 rooms of the Chicago Conrad Hilton, the world's largest hotel, with individual air conditioning and heating units, we looked for a tubing that was simple to apply, required a minimum of labor to install, and gave us a perfect vapor seal from 40° F to 220° F at minimum cost," said Albert J. Schauer, design engineer for York Corporation, York, Pennsylvania.

"B. F. Goodrich Cell-Tite solved our problem perfectly. In fact, we are using 35,000 feet.

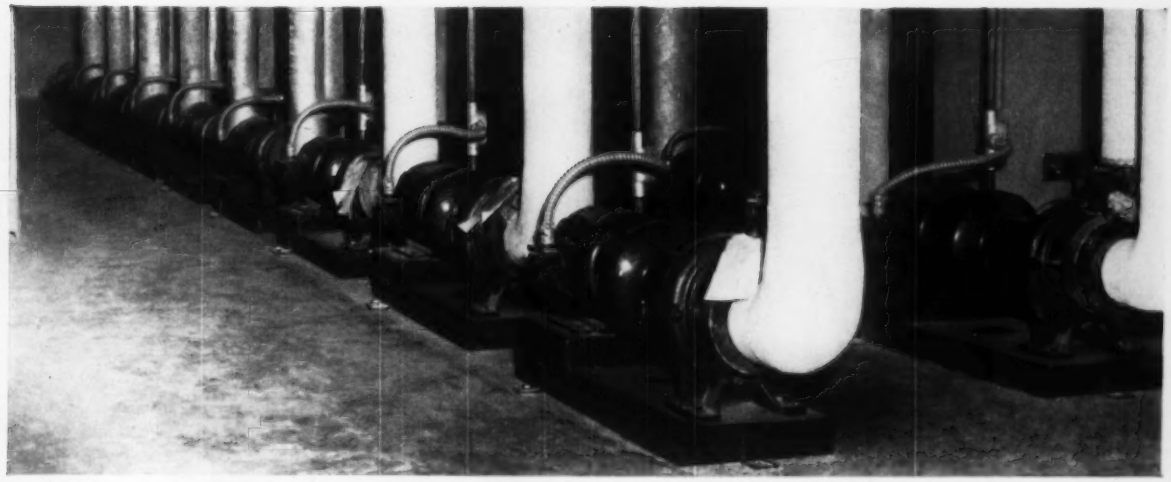
"B. F. Goodrich Cell-Tite's primary advantage is its versatility. It's pliable, slips over any given configuration, any twists and turns with ease.

"Another major labor-saving technique is prefabrication: we prefabricated much of the pipe before installation, cut our labor time by 50%. Time-saving features like this keep us right on schedule. B. F. Goodrich Cell-Tite comes in practical 50-foot lengths, too. This saved about 15% over the cost of other types of insulators that come in shorter lengths.

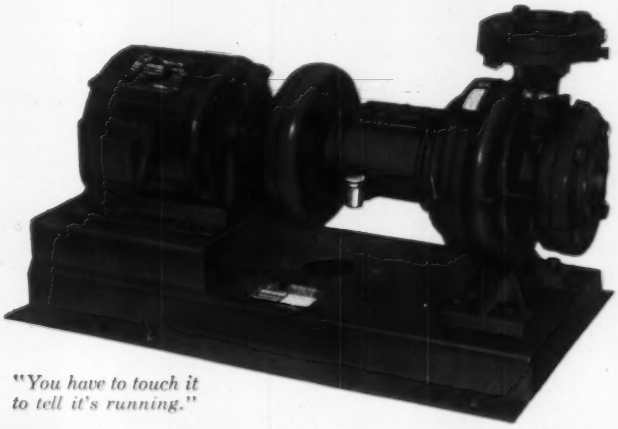
"Since B. F. Goodrich Cell-Tite is made of thousands of tiny individual air cells, completely sealing the copper tubing from the air, there is no air leakage and no condensation. We regard it as the perfect seal."

Find out how you can cut costs, simplify installation on your next job. Write The B. F. Goodrich Company, 481 Derby Place, Shelton, Connecticut.

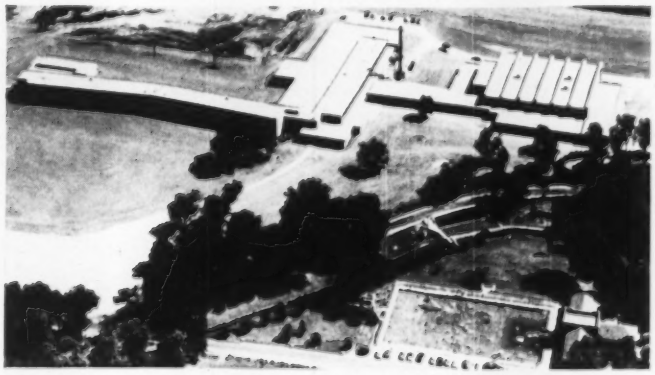
B.F.Goodrich
insulation tubing



EIGHTEEN B&G UNIVERSAL PUMPS DELIVER Quiet HEAT



"You have to touch it to tell it's running."



Parkview High School, Springfield, Mo.

Architect: Richard P. Stahl, Springfield, Mo.
Engineer: R. W. Bare, Springfield, Mo.
Contractor: McCarty Co., Springfield, Mo.

Selecting a pump for a circulated water heating or cooling system is not merely a matter of proper head and capacity. *Quiet, vibrationless operation is of major importance!*

In the modern school shown here, eighteen B&G Universal Pumps deliver heat without distracting noise. These pumps are designed specifically for heating system use...built to perform dependably and *silently*. No vibration eliminators or flexible connections to the piping are needed.

Universal Pump motors, for example, are specially constructed and selected for *extra-quiet* operation. Long *sleeve* bearings are used in both motor and pump—another assurance of smooth, vibrationless operation and long life of both pump and motor. The oversized shaft is made of special alloy steel with an integral, heat-treated thrust collar to absorb end-thrust. Water leakage is prevented by the diamond-hard "Remite" mechanical seal...a B&G development.

Note, too, that *vertical* split case construction with removable bearing frame permits easy servicing without breaking pipe connections or motor leads.

B&G BOOSTER

An in-line pump of smaller capacities than the B&G Universal, but with the same features which assure quiet operation.

BELL & GOSSETT
COMPANY
Dept. FL-5 Morton Grove, Illinois

Reg. U.S. Pat. Off.

Canadian Licensee: S. A. Armstrong Ltd., 1400 O'Connor Drive, Toronto 16, Ontario

HIDEAWAY SEASONMAKER

McQUAY Means Quality

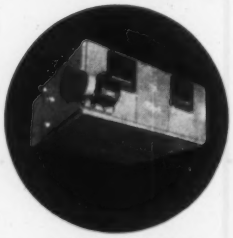
When you think of quality, you automatically think of McQUAY, because McQUAY MEANS QUALITY.

Only McQuay units are equipped with the famous and exclusive Ripple Fin coils which create the maximum air turbulence necessary for efficient heat transfer. Expanding the copper tube against the wide, full fin collars, which act as automatic spacers, provides rigid metal-to-metal contact and completely covers the copper coil to form a "tube within a tube".

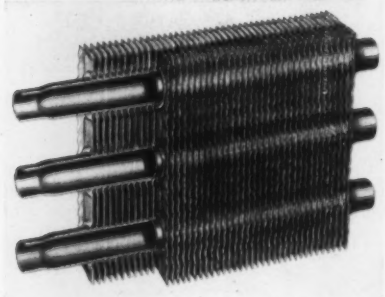
The complete McQuay product line is constructed of the finest heavy gauge materials—combined with the NEW McQuay Galva-Seal process, bonderized and then finished with a special formula enamel baked on—offering you the finest corrosive resistant assembly available. And, the Dura-Frame "V" channel construction, another McQuay exclusive, provides the strength and rigidity necessary to quiet, trouble-free operation.

There is no substitute for quality, no substitute for the experience and the research and engineering for which McQuay is famous.

Compare McQuay in every way—from the appearance and beauty of the finished product to the heart of each unit, the coil itself—and you will readily see why McQUAY MEANS QUALITY—and quality means performance and long life. McQuay, Inc., 1601 Broadway Street N.E., Minneapolis 13, Minnesota.

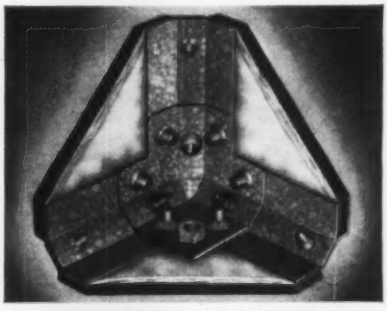


SEASONMASTER AIR CONDITIONER

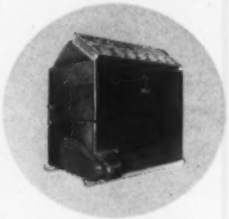


RIPPLE FIN COIL CONSTRUCTION

INDIVIDUAL ROOM SEASONMAKER

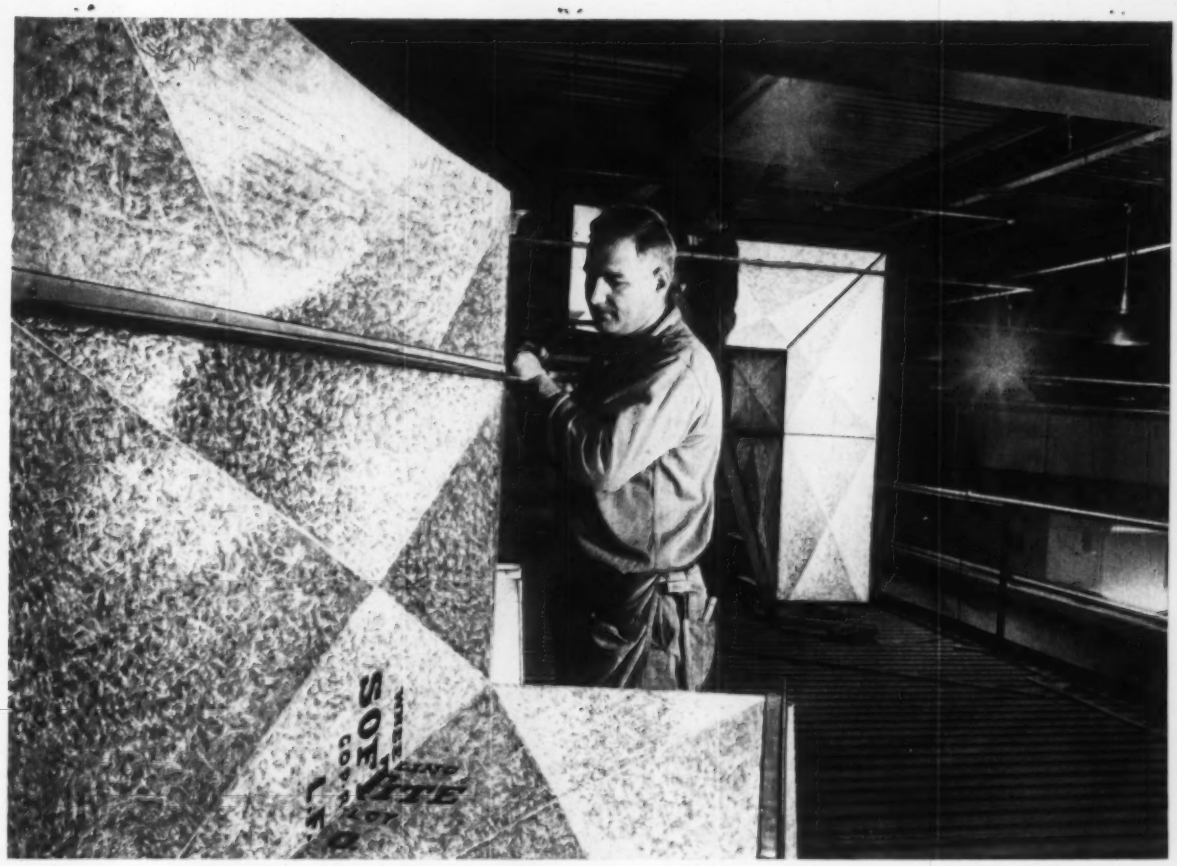


DURA-FRAME "V" CHANNEL CONSTRUCTION



MULTI-ZONE AIR CONDITIONING UNIT

McQuay Means Quality



Operator: *Pratt & Whitney Division, United Aircraft Corp., Hartford, Conn.* **General Contractor:** *Davidson Construction Company, Manchester, New Hampshire.* **Heating Contractor:** *C. N. Flagg Company, Meriden, Conn.* **Sheet Metal Contractor:** *G. R. Cummings Company, Meriden, Conn.*

Wheeling SOFTITE Galvanized Sheets selected for Connecticut Aircraft Nuclear Engine Laboratories installation

SOFTITE *used in this project included 20 and 22 gage sheets for supply lines; 24 and 26 gage for interior room ducts.*

A major installation at the U.S. Air Force's highly secret Connecticut Aircraft Nuclear Engine Laboratories, Middletown, Connecticut, has a single duct system that required over 65 tons of Wheeling SOFTITE® Cop-R-Loy® Galvanized Sheets.

According to G. R. Cummings Company, sheet metal fabricators on the job, SOFTITE was selected because the ductwork was to be left exposed and "SOFTITE's uniform, attractive coating improved the appearance of the job."

What's more, SOFTITE affords many other important advantages. For example, it can be bent and hammered into seams that require double folds in fraction-of-an-inch areas without danger of flaking.

And long service under adverse conditions is assured by the use of Cop-R-Loy – Wheeling's famous long-lived copper-bearing steel.

Find out how SOFTITE can help you from our nearest sales office or distributor. Wheeling Steel Corporation, Wheeling, West Virginia. **IT'S WHEELING STEEL**

OUR CHALLENGE STILL STANDS: ANYTHING THAT CAN BE MADE OF STEEL SHEETS CAN BE MADE OF WHEELING SOFTITE GALVANIZED STEEL SHEETS.

District Sales Offices at Atlanta, Boston, Buffalo, Chicago, Cincinnati, Cleveland, Detroit, Houston, New York, Philadelphia, St. Louis, San Francisco, Wheeling

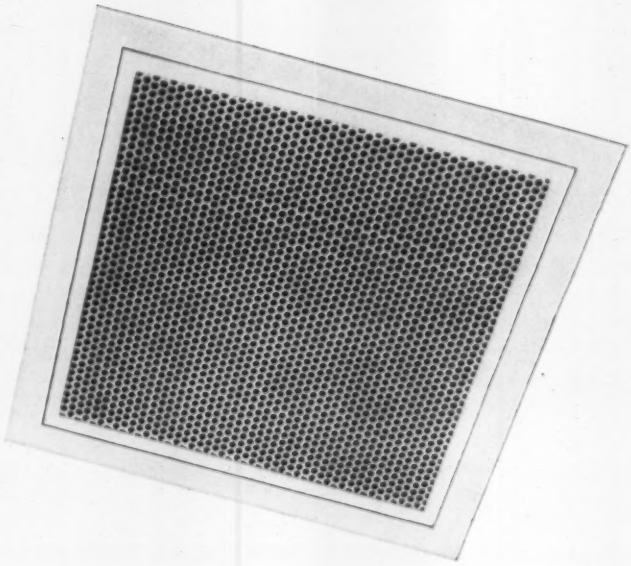
From our research and product development laboratory

AGITAIR®

Perfair

SQUARE AND RECTANGULAR

PERFORATED AIR OUTLETS



WITH THESE PRACTICAL PERFORMANCE FEATURES

- Provide Uniform Ceiling Design
- Can Be Located Anywhere In Ceiling
- Interchangeable Diffusing Cores
- Unlimited Patterns
- Built-In Air Controllers
- Adjustable for 1-2-3-4 Way Blows
- No Blank-Offs Required
- Maximum Turbulence — Aspiration
- Quick Temperature Equalization
- Uniform — Draftless Air Distribution

THE ULTIMATE IN APPEARANCE AND VERSATILITY

AGITAIR PERFAIR air diffusers incorporate all the essential features to meet the architects and engineers requirements.

The architectural styling of PERFAIR, both supply and matching return units, conform to all interior designs. The interchangeable core feature and built-in air controllers permit the location of PERFAIR units in any part of the ceiling as desired by the architects.

Engineers can depend upon AGITAIR PERFAIR air diffusers to meet their every requirement — maximum turbulence...aspiration...quick temperature equalization . . . uniform air distribution ...noiseless...draftless operation.'

For quick and easy installation of PERFAIR units, separate mounting frames are available for surface and tile applications.

Ask your AGITAIR representative for catalog P-200 or write direct to Air Devices Inc.

THERMOTANK — AGITAIR

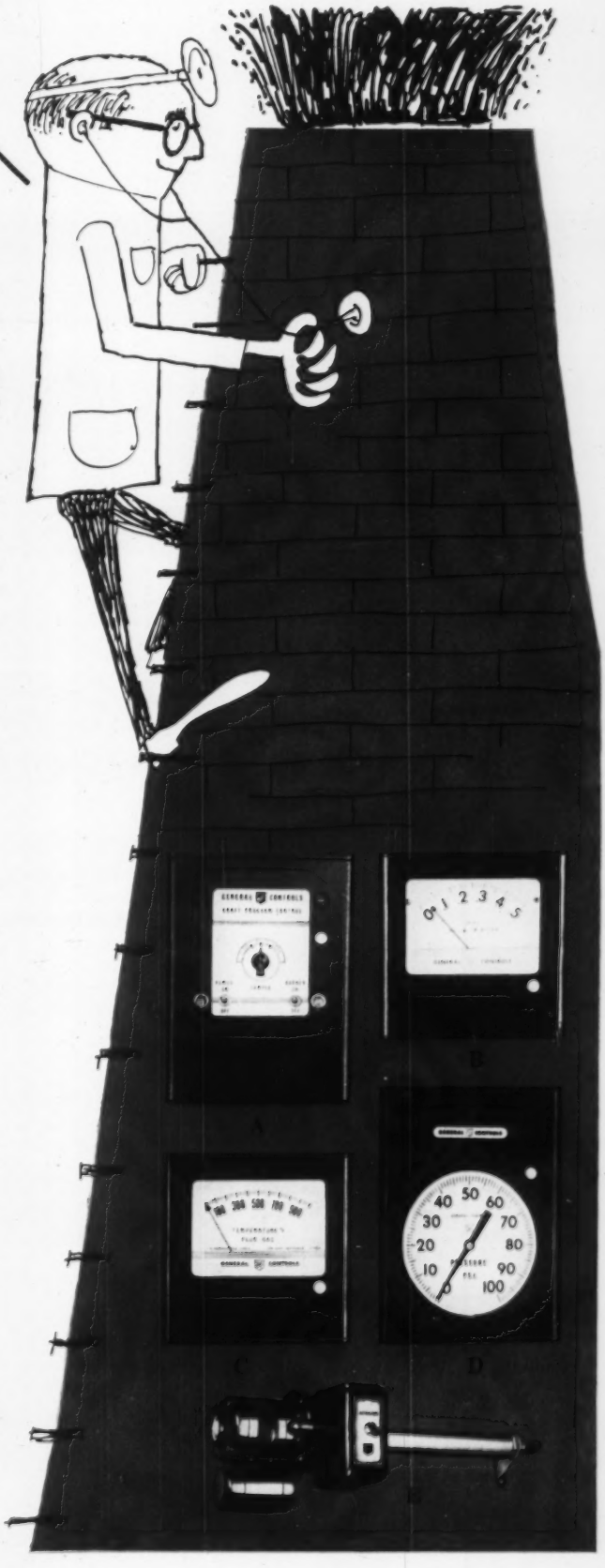
high velocity units • punkah louvers
air diffusers • filters • exhausters
registers and grilles

Sold exclusively by representatives for:

AIR DEVICES INC.

185 MADISON AVENUE, NEW YORK 16, N. Y.

"My advice:
QUIT SMOKING!"



Smoking costs too much. It's a sure sign fuel is being wasted... that burner and boiler are losing efficiency... that profits are going up with the smoke. But you *can* do something about it! **Install a GENERAL CONTROLS DRAFT CONTROL SYSTEM.**

Goes in easily and inexpensively with any type boiler...any type fuel. Pays for itself over and over again through the years by cutting fuel waste... saves as much as 25% on fuel cost as well as saving on manpower. Not least, think of the plant and city-area good will you'll create with effective smoke control.

Call in the GENERAL CONTROLS MAN in your area to check out a draft control system for your plant now. The sooner, the better your long-range profit picture will look.

HOW TO IMPROVE YOUR BOILER EFFICIENCY:

A DRAFT PROGRAM CONTROL: start-up, shut-down, sets damper for any firing rate. Fast, accurate...senses atmospheric changes.

B DRAFT INDICATOR: provides continuous visual readings of draft conditions in combustion chamber and/or stack.

C FLUE GAS TEMPERATURE INDICATOR: shows boiler efficiency by indicating excessive heat loss.

D STEAM PRESSURE INDICATING CONTROLLER: indicates boiler pressure on main instrument panel, and gives accurate on-off, or proportioning control.

E ACTUATOR: operates stack damper to maintain constant combustion chamber draft.

A draft control system like this is worth money in the bank to you. Get the full facts today from

GENERAL CONTROLS

Manufacturers of America's Finest Automatic Controls for Home, Industry and the Military

Glendale, Calif. • Skokie, Ill. • Guelph, Ontario, Canada

Six Plants—42 factory branch offices serving the United States and Canada

this **WALKER SHUR-FLO** Draft Inducer-Regulator *Unit...*

ENDS DRAFT PROBLEMS RIGHT FROM THE START...

MODELS For Gas... Oil... and Solid Fuels!

"I don't fuss and fret with uncertain draft anymore since Walker brought out this low-priced draft inducer-regulator combination. Now, I install Walker inducers on all my jobs. That puts me way out ahead, because with good draft I know every job will be exactly right from the start."

THE INSIDE STORY OF SHUR-FLO EFFICIENCY

- Hi Volume Self-Feathering Fan
- Self-Cleaning Blades (No soot build-up)
- Stainless Steel Shaft, Hub, and Blades
- Quiet, burn-out proof motor
- Silicone oiled Bearings
- Extra heavy gauge galvanized steel construction
- Extra rigid mountings.

"Most Efficient Draft System Ever Made"

Say Heating Contractors, Architects, Home Owners

Draft problems are eliminated with a Walker Shur-Flo Control (Pats. Pending) in an oil, coal, or gas-fired installation because it's the SUREST DRAFT SYSTEM ever devised.

Here's an economical draft inducer that's a fool-proof answer to every draft problem from older heating installations to modern, low-roofed houses. You just install it and forget it. What could be better?

Moreover, the Walker Shur-Flo with fan operated draft inducer moves ONLY flue gases; does not suck in outside air. Building and home owners like the Shur-Flo because it runs quietly, costs less to operate, and requires little power. You'll like the Shur-Flo because it installs quickly at any angle—vertically, horizontally, or at a pitch—and virtually eliminates costly callbacks and corrections.

For full details, see your supplier or write direct

WALKER MFG. AND SALES CORP.

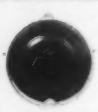
1720Penn Street St. Joseph, Missouri

There's a Walker Draft Control Scientifically Designed to Meet Every Draft Problem Regardless of Fuel. 28,000,000 in Use Prove Efficiency. The Standard of Performance for the Industry.

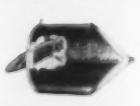
ROYAL PURPLE
for smaller central heating plants

TYPE 34
for larger special central heating

JUNIOR LINE
central heating budget control



TYPE BB
commercial and industrial control



DOUBLE SWING
for gas fired equipment

VENTURI CAP
for heating and ventilating

Bullock's Santa Ana, new branch of a famous California store.
Webco-Ray units installed: 1 200hp; 1 40hp; 1 30hp.
Planning-Architecture-Engineering: Pereira & Luckman.
General Contractor: C. L. Peck.
Heating & Ventilating Contractor: Mehring & Hanson Company.

more proof!

Your heating dollar goes further with Webco-Ray packaged units

Specification of three Webco-Ray packaged units for the new 12.5 million dollar Bullock's Santa Ana Store proves it again: there's more value in a Webco-Ray packaged unit. Their three pass design assures 80 plus percent efficiency; and compact Webco-Ray construction requires minimum valuable floor space. But the big *plus* factor is Webco-Ray's nation-wide dealer system that provides factory-backed local service wherever a unit is installed. Sizes available from 10 to 600 horsepower.

5043

WESTERN BOILER COMPANY
1600 North Indiana St., Los Angeles 63, California
1309 Eighth Street, North Bergen, New Jersey

WEBCO-RAY
PACKAGED BOILERS

KNOWN

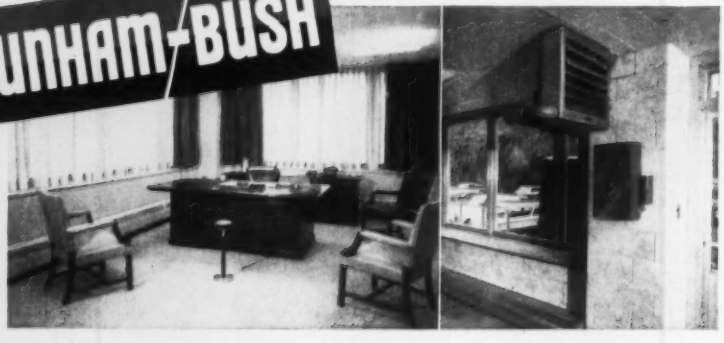
MILK CHOCOLATE NESTLE'S

NESTLÉ'S

for fine food products

New American Headquarters of The Nestlé Company, Inc., White Plains, N.Y.
Baseboard, steam specialties and unit heaters supplied by Dunham-Bush.

DUNHAM-BUSH



for dependable heating products

At Nestlé, good taste is packaged. At the heating specification level, good taste is Dunham-Bush. And more and more specifications include dependable Dunham-Bush heating, air-conditioning and refrigeration products for America's outstanding buildings.

Dunham-Bush, Inc.

WEST HARTFORD 10 • CONNECTICUT • U. S. A.

DUNHAM-BUSH

AIR CONDITIONING • REFRIGERATION • HEATING • HEAT TRANSFER

WEST HARTFORD, CONNECTICUT • MICHIGAN CITY, INDIANA • MARSHALLTOWN, IOWA
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DUNHAM-BUSH DUNHAM-BUSH, LTD., LONDON, ENGLAND · BRUNNER BRUNNER CORPORATION (CANADA) LTD., PORT HOPE, ONTARIO

New!

this golden cap identifies Freon * *premium quality refrigerants*

DU PONT

Better Things for Better Living
. . . through Chemistry

factory sealed for purity by Du Pont

Coming soon! Gold-capped cylinders—the new way to identify "Freon" premium quality refrigerants. Each gold-capped cylinder of "Freon" is *factory-sealed* by Du Pont to make sure you get the high purity guaranteed by 27 years of manufacturing leadership.

Today "Freon" is so dry and pure that the published specifications for "Freon" refrigerants are the accepted standards of quality for the entire industry. Best of all, "Freon" costs no more than refrigerants that are supposed to be "just as good". So *insist on "Freon"*—the time-tested, premium quality refrigerants—now identified by cylinders with the new gold colored hood cap.

FREON®

premium quality

refrigerants

*Freon and combinations of Freon- and F- followed by numerals are Du Pont's registered trademarks for its fluorinated hydrocarbon refrigerants.

WANTED

PHIL FLANGE

(ALIAS ECONOMY OF PERFECTION)

DESCRIPTION:

1. SELF-CENTERED. Another OTM FIRST. Every Flange is centered for faster, surer installation. Saves time, expense.
2. Wears OTM Blue Ribbon Guarantee (Only flange in the world with such a guarantee.)
3. Welding neck, threaded, slip-on, ASA lap-joint and blind, may be ½" through 24"—150 through 2900 lbs.
4. Close tolerance—1/32" concentricity—the closest in the industry—makes welding easier.

WARNING:

Phil "The Blue Ribbon Flange" has a concentric serrated face. He works 24 hours a day—never tires under pressure. BE ON THE LOOK OUT FOR HIM—NEVER GOES UNDER ANY NAME EXCEPT OTM BLUE RIBBON!

IF YOU SEE HIM—YOU'RE LUCKY—IF YOU DON'T—LOOK FOR HIM!

WANTED BY PIPEFITTERS AND PLUMBERS ALL OVER THE WORLD

REWARD: **OTM Blue Ribbon Guarantee—the most comprehensive written guarantee in the industry!**

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OTM CORPORATION

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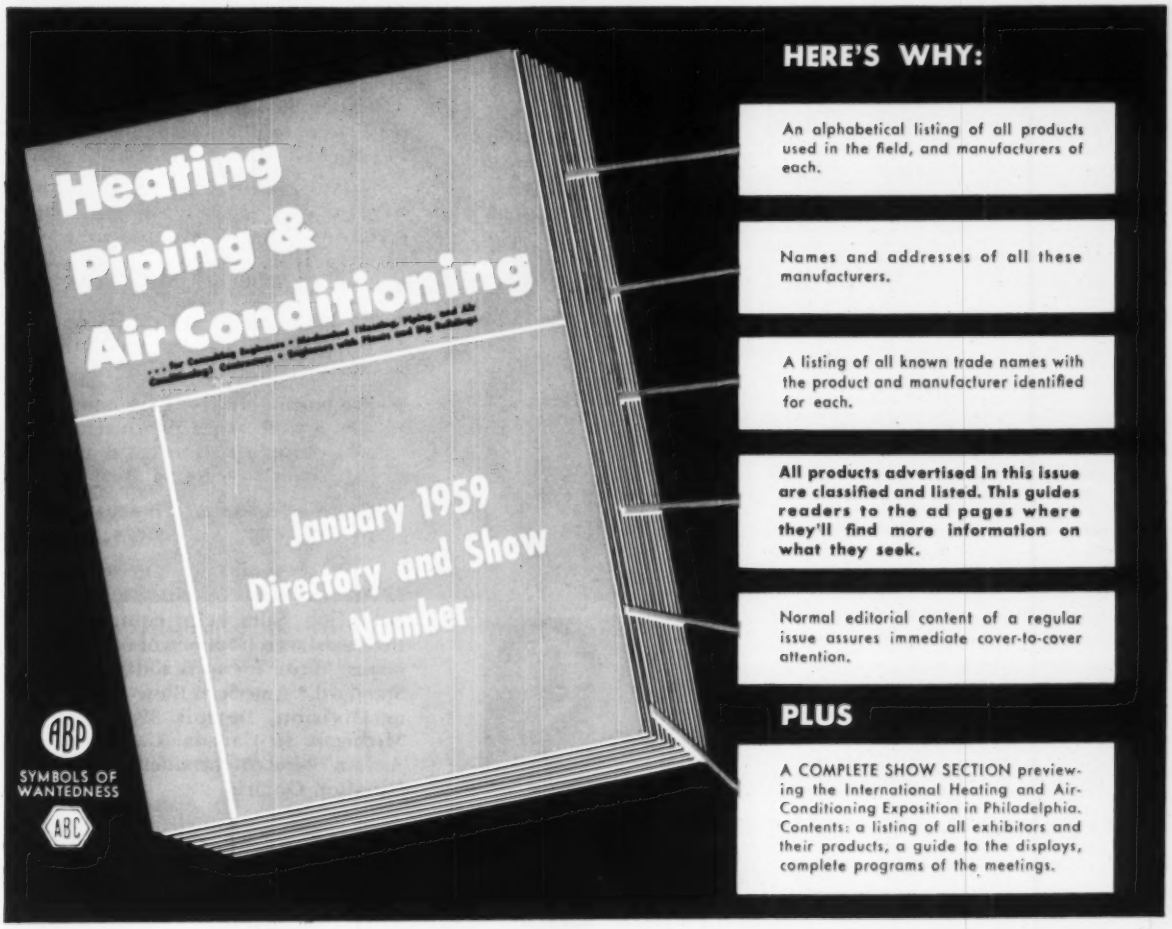
"Who makes it?" "Where can we get it?"

Since 1934 this annual Directory has given the answers to

CONSULTING ENGINEERS • MECHANICAL CONTRACTORS • ENGINEERS in INDUSTRIAL PLANTS • ENGINEERS in LARGE BUILDINGS


Heating
Piping &
Air Conditioning
January 1959
Directory and Show
Number
ABP
SYMBOLS OF
WANTEDNESS
ABC
HERE'S WHY:
An alphabetical listing of all products used in the field, and manufacturers of each.
Names and addresses of all these manufacturers.
A listing of all known trade names with the product and manufacturer identified for each.
All products advertised in this issue are classified and listed. This guides readers to the ad pages where they'll find more information on what they seek.
Normal editorial content of a regular issue assures immediate cover-to-cover attention.
PLUS
A COMPLETE SHOW SECTION previewing the International Heating and Air-Conditioning Exposition in Philadelphia. Contents: a listing of all exhibitors and their products, a guide to the displays, complete programs of the meetings.

This field's complete, authoritative Buyers' Guide. Regular space rates apply

Consider for a minute how our *all paid* subscribers (engineers and contractors *specializing* in heating, piping and air conditioning work) use this January Directory.

Take Mr. B. He's seeking your type of product. He's found those who make it. He's also discovered the firms who are advertising it in the very book he now has open. Wanting all the information he can get at that moment, he'll most certainly turn to these advertising pages.

What an opportunity! Will you be there? Chances are your competition will be (nearly 300 advertisers appear each year). Make sure you will be, too. Reserve sufficient space to tell your full story, to parade your entire line. Remember, no premium is charged for this bonus-filled issue. It is not a 13th or extra-cost number. Act now. Closing date, December 10.

P.S. Here's *proof* of the lasting sales power of this field-specialized Directory: In a survey of our *all paid* subscribers, 96% report they keep this Directory throughout the year, 75% refer to the advertising pages as they use the Directory, and 91% regard the Directory as useful to them. Real value for them . . . real value for you!

Heating, Piping & Air Conditioning

KEENEY PUBLISHING CO. AIR CONDITIONING HEADQUARTERS

6 N. Michigan, Chicago

"Off-the-shelf" delivery

— another example of how you benefit when you select American Blower ventilating equipment

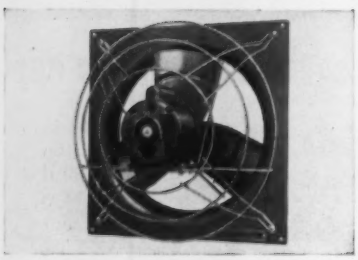
Efficiency-boosting ventilation practically sells itself; fast delivery *clinches* sales. So cash in now! Deliver quiet, efficient American Blower Ventura Fans "off-the-shelf" from *local* stocks, and watch profits increase!

Easy-to-install Ventura Fans move large volumes of air at low cost. They're designed to run quietly, and are competitively priced. Compact and attractive, Ventura Fans offer customers:

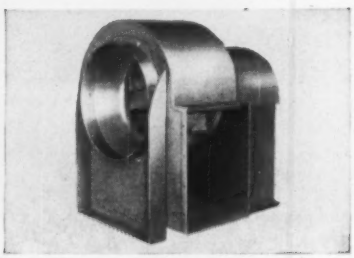
- **Packaged ventilation** – Complete, ready to use. Fast, economical installation.
- **Pre-engineering** – Each model handles a wide range of capacities. Just pick proper fan directly from the catalog. No on-the-job engineering needed.
- **Certified Ratings**—Air deliveries meet rigid standard test codes.

For *extra* profits, sell the *complete* line of American Blower fans for every ventilating job. Sales help: equipment selection assistance from one of our 73 branch offices. Write for facts today! American-Standard,* American Blower Division, Detroit 32, Michigan. In Canada: Canadian Sirocco products, Windsor, Ontario.

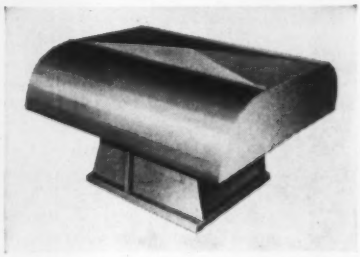
It pays to standardize on American Blower!



Ventura Fans – quiet, efficient, economical. Sizes from 10" to 30".



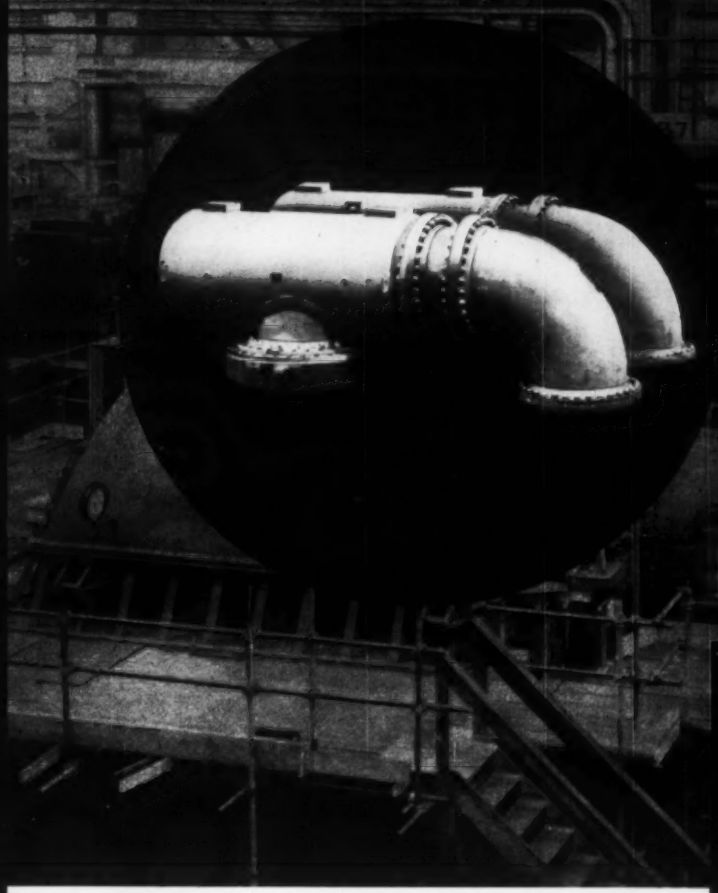
Utility Sets – direct drive, sizes 3" to 12¼"; V-belt drive, 9" to 36".



Power Roof Ventilators – available through American Blower branches.

* American-Standard and Standard® are trademarks of American Radiator & Standard Sanitary Corporation.

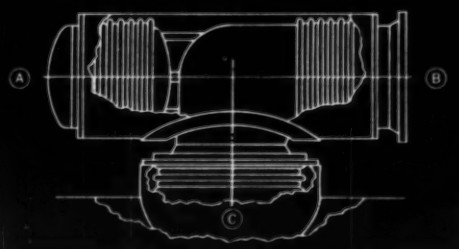
AMERICAN-Standard
AMERICAN BLOWER DIVISION



GIANT Turbine Expansion Joints Built by BADGER

Photo shows 150,000 kw steam turbine-generator unit undergoing tests prior to shipment at General Electric's Turbine-Generator Plant in Schenectady, N. Y. Badger Expansion Assembly is clearly visible atop turbine.

Badger balanced elbow expansion assembly.



Joint A balances thrust due to internal pressure of 65-150 psi; joint B absorbs axial movement; joint C absorbs the differential expansion between the inner and outer casings of the turbine. Assemblies range in size from 36 to 42 inches in diameter.

Custom engineered assemblies include many features of Badger S-R Design

750°F steam is flashed through these turbine crossovers at speeds up to 150 ft/sec and pressures up to 150 psi.

How do you protect piping and turbine casings from the stresses of extreme internal pressure and the expansion such temperature is bound to produce?

Working together, Badger and engineers at General Electric's Large Steam Turbine-Generator Department solved the problem with a new type pressure balanced elbow expansion assembly. Using two separate joints mounted in a T-shape casing (see diagram) the assembly effectively absorbs and controls axial movement. Although the device was custom engineered to General Electric's requirements, the bellows elements are constructed to the Curvilinear Corrugation design recently announced by Badger and now used in all S-R Expansion Joints.

Whether you need standard S-R Expansion Joints or custom equipment, Badger can serve your needs. Get more information — write for illustrated brochure today.

New corrugation and ring designs produce better equalization, "all-curve" flexing

Curvilinear Corrugations used in S-R Expansion Joints were developed by the Badger Research Department. Under operating pressures (white line) the new design produces more uniform movement per corrugation and natural "all-curve" flexing. Stress is reduced... life increased.

Series 50 corrugation cross-section

S-R Joints for higher pressures have tubular Reinforcing Rings. These new rings make metal-to-metal contact only in the "valley" of each corrugation allowing natural "all-curve" flexing (white line). Tubular shape permits greater effective flexing height which contributes to longer life.

Series 150 corrugation and ring cross-section

BADGER

S R

SERVICE RATED

EXPANSION JOINTS

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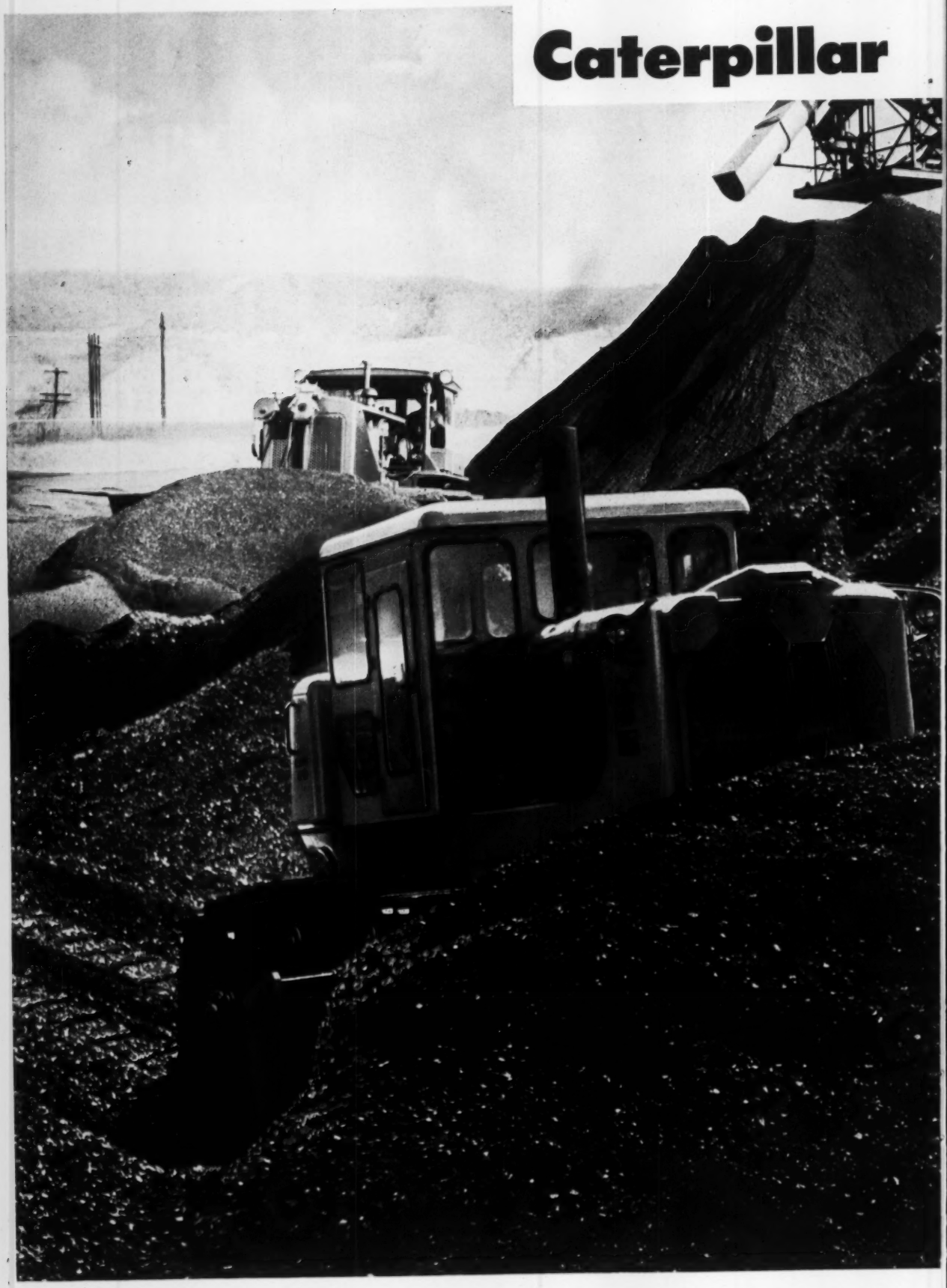
BADGER MANUFACTURING COMPANY
230 Bent St., Cambridge 41, Mass. • 60 East 42nd St., New York, New York
Representatives in Principal Cities


Caterpillar

makes tracks for coal

Seven Caterpillar Tractor Co. plants burn coal for low-cost steam generation

When seven plants of a company all burn coal—over 250,000 tons a year—you can be sure there's a *good* reason. At Caterpillar Tractor Co., where steam is used for both process work and heating, coal is burned for low-cost, efficient steam production.

Because of its importance at Caterpillar, steam generation must meet the same standards of efficiency and dependability set up for all phases of plant production. As Caterpillar has expanded from one plant to many, therefore, *each* plant has burned coal.

Facts you should know about coal

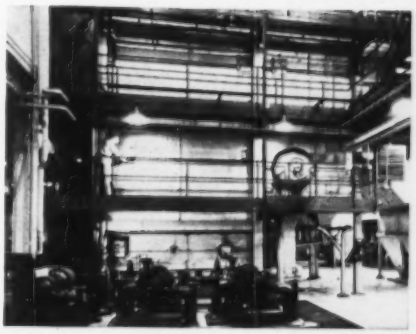
You'll find that bituminous coal is not only the lowest-cost fuel in most industrial areas but up-to-date coal burning equipment can give you 15% to 50% more steam per dollar. Today's automatic equipment can pare labor costs and eliminate smoke problems. And vast coal reserves plus mechanized production methods mean a constantly plentiful supply of coal at stable prices.

Technical advisory service

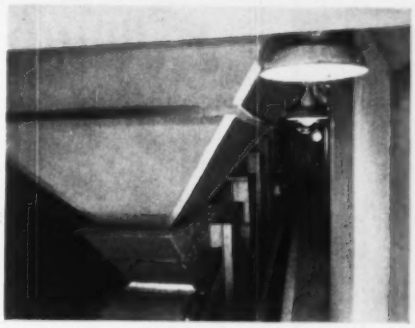
To help you with industrial fuel problems, the Bituminous Coal Institute offers a free technical advisory service. We welcome the opportunity to work with you, your consulting engineers and architects. If you are concerned with steam costs, write to the address below. Or send coupon below for our case histories booklet, complete with data sheets. You'll find it informative.

Consult an engineering firm

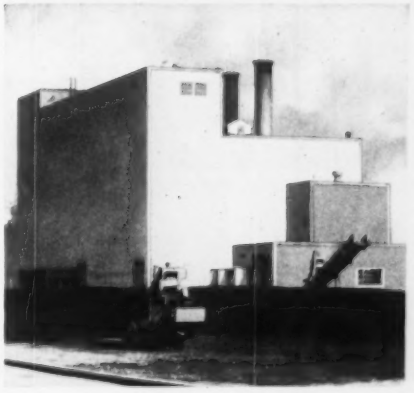
If you are remodeling or building new heating or power facilities, it will pay you to consult a qualified engineering firm. Such concerns—familiar with the latest in fuel costs and equipment—can effect great savings for you in efficiency and fuel economy over the years.



Power house at Morton, Ill. plant uses two 60,000 lb/hr Wickes boilers, 3 stories high. These are equipped with Hoffman continuous ash-discharge spreader stokers.



Track unloading hopper at York plant. Coal feeds from belt conveyor to bucket conveyor to distributing flight conveyor over storage bunker. Coal handling system by Beaumont Birch.



Exterior view of power plant at Joliet, Ill. Foreground shows part of outside coal storage area featuring portable car unloader and stacker. Coal is stocked out and reclaimed by Caterpillar bulldozer-equipped crawler tractor.

BITUMINOUS COAL INSTITUTE

Department HP-10,
Southern Building • Washington 5, D. C.

SEND COUPON FOR *NEW* "Guide Specifications for Underfeed Stoker Fired Low-Pressure Commercial Heating Plants." Heavy demand for the first edition of this booklet, adaptable for design loads 3,000 to 26,000 EDR steam, has justified an expanded edition covering application of underfeed stokers to firetube, watertube and section cast iron boilers. Complete specification criteria cover all aspects of typical heating plant. HP-10

☐ Guide Specifications booklet ☐ Case histories on larger plants

Name _____

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Company _____

Address _____

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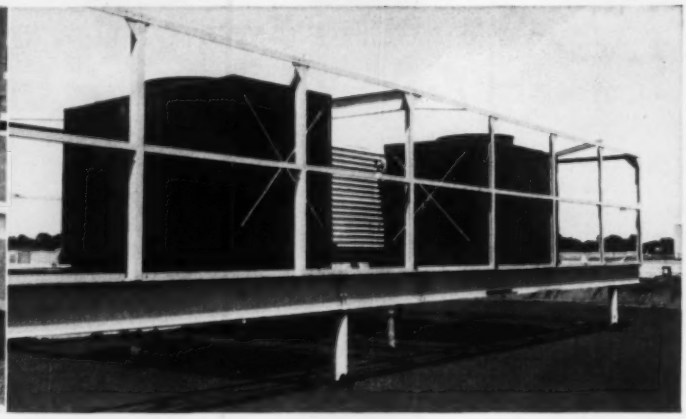
Durability and dependability



go up with MARLEY PERMATOWERS®

. . . That's why Permatowers were selected by major national and local merchandisers in mid-America's newest modern shopping center, Blue Ridge at Kansas City, for air conditioning and refrigeration requirements in their stores.

Marley Permatowers are the newest of packaged cooling towers and are designed for maximum resistance to corrosion. They combine the time-proved design principle of Marley industrial double-flow towers with such new time-proof design features as distribution manifolds, internal piping and depressed sumps molded of Kralastic type resin; polyester resin reinforced fiber glass fan cylinders, and casings of water-proof laminated panels with resin-impregnated fiber surfaces. The result is PERFORMANCE with PERMANENCE that make Permatowers the premium package for jobs that impose most rigorous service conditions.

Permatowers come "ready for work" in 11 sizes that cover a wide range of commercial and institutional water cooling requirements. For complete information on *"the towers that time can't touch"*, write for bulletin PT-58, or call your Marley application engineer in 56 cities.

Marley equipment and components covered by U. S. and Foreign Patents and Patents Pending

The Marley Company
Kansas City, Missouri

MARLEY

Expansion and contraction of the plastic pipe is controlled by rubber shock cords connected to hooks on the rink rim.

Skating Rink—Dance Floor features freezing system of polyethylene pipe

At this convertible ice skating rink, installed by the Kalamazoo, Michigan, Parks Department, city residents can frolic all year 'round.

Eleven miles of USS National Polyethylene Pipe, NSF Grade, make up the brine-circulating system—3,700 gallons of brine at 35 psi. The lightweight plastic pipe can be removed in just one day to permit dancing or roller skating on the rink's smooth floor. When not in use, the pipe, with 2,640 gallons of the brine still in it, is stored in a trench next to the rink.

Installation of the pipe was completed in two days by a crew who had no previous experience installing a freezing system of polyethylene pipe. The pipe has a 1" inside diameter and a wall thickness of only 1/10 of an inch. Its glass-smooth inner walls greatly reduce friction and minimize pumping problems. When the pipe is disconnected in the Spring, each 185-foot loop, including the brine, will weigh about 110 pounds—light enough to permit easy handling by a small crew.

USS National Polyethylene Pipe, NSF Grade, can't be harmed by most acids, salts, alkalis or other chemicals. It remains flexible in temperatures from −90°F. to +120°F. The pipe is made from 100% virgin polyethylene to which 2% of an inert black pigment filler has been added to prevent deterioration from ultraviolet rays.

For full information, write to National Tube Division, United States Steel, 525 William Penn Place, Pittsburgh 30, Pa. Ask for Bulletin No. 29. *USS and National are registered trademarks*

"The world's largest and most experienced manufacturer of tubular products"

National Tube Division of USS United States Steel

Columbia-Geneva Steel Division, San Francisco, Pacific Coast Distributors • United States Steel Export Company, New York

PARTIAL VIEW of Rockledge Homes, Abington Township, Penna. All 106 homes have Anaconda copper tube sanitary drainage lines.

"I do a better job at lower cost—with Copper"

J. L. FITZPATRICK of J. L. Fitzpatrick & Sons, Jenkintown, Penna., plumbing contractor for Rockledge Homes development, watches journeyman Sam Duper, Jr., connect a 3-inch copper tube soil line from bathroom to the stack. Anaconda Tube for the development was supplied by Fleck Company, Elkins Park, Penna., plumbing supply wholesaler.

J. L. Fitzpatrick switched to Anaconda copper tube for sanitary drainage lines—finds installation easier—gives builders and homeowners superior plumbing systems.

"We all know that copper plumbing is best and there's no mystery about the cost angle," said J. L. Fitzpatrick.

"It is simply a matter of copper tube and solder-joint fittings being so much easier and faster to install. Copper handles right. . . . It's light and easy to cut. And where you have long runs, the 20-foot lengths of copper tube eliminate many joints. We also save the time and trouble of making threaded or caulked connections.

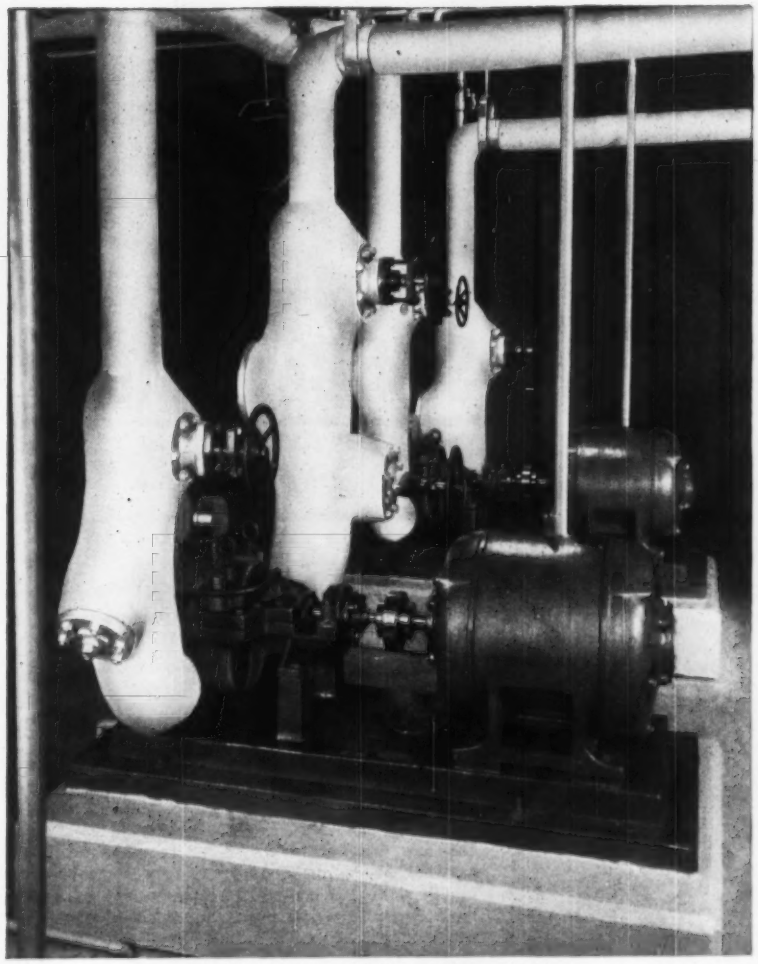
"And our men like to work with copper, not only because it's easier—but because they can turn out a neat, trim job they're proud of."

More and more plumbing contractors are standardizing on copper tube for drainage lines for the reasons given by Mr. Fitzpatrick. And in areas where plumbing codes were written years ago, contractors are asking for revisions to include copper tube as an approved material for sanitary drainage systems.

Builders and owners also benefit from all-copper plumbing in many ways. A 3" copper tube stack with fittings can be installed in standard 4"-wide partitions. Carpentry, lumber, and space are saved. Plumbing can be laid out to meet owners' wishes regarding location of fixtures and appliances. All-copper plumbing is a mark of quality—a sign of low maintenance and high resale values.

Write for descriptive literature on ANACONDA ALL-COPPER plumbing. Address: The American Brass Company, Waterbury 20, Conn. In Canada: Anaconda American Brass Ltd., New Toronto, Ontario. 5801

ANACONDA®
COPPER TUBE and FITTINGS
Available through plumbing wholesalers
Made by
THE AMERICAN BRASS COMPANY



"Buffalo" Class "RR" Two-Stage Pumps

THEY PUMP MORE WATER AT LOWER COST

TESTIMONIALS from satisfied users prove the outstanding performance record of "Buffalo" Class "RR" Single Suction Multi-stage Pumps. These sturdy pumps are specially designed for high pressure and temperature clear water conditions.

The constant hydraulic balance of the "RR" design is the key to the high efficiencies these pumps deliver on the job. Rugged construction, generous bearings, extra-deep stuffing boxes — all add up to peak performance and long-lived dependability.

"Buffalo" Class "RR" Pumps are available in two and four-stage models, and in a variety of sizes to suit your needs. You will find them a best buy for any clear water service — hot or cold, at pressures up to 1500 ft. heads and at capacities from 20 gpm to 900 gpm.

Your nearby "Buffalo" Engineering Representative will be glad to show you the advantages of "Buffalo" Class "RR" Pumps — or write for Bulletin 980-E.

Every "Buffalo" product brings you the famous "Q" Factor — the built-in QUALITY which provides trouble-free satisfaction and long life.

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DIVISION OF BUFFALO FORGE CO.

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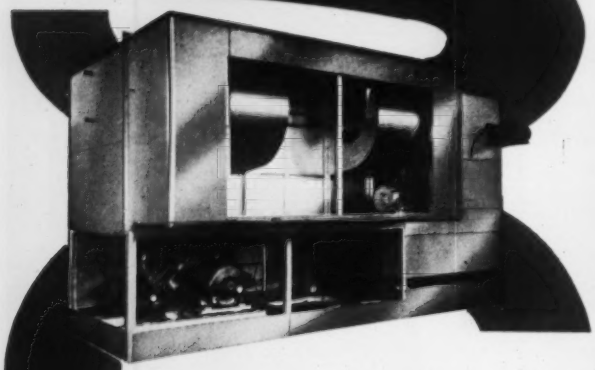
A BETTER CENTRIFUGAL PUMP FOR EVERY LIQUID

"SATISFABRICATED" for Your Requirements . . .



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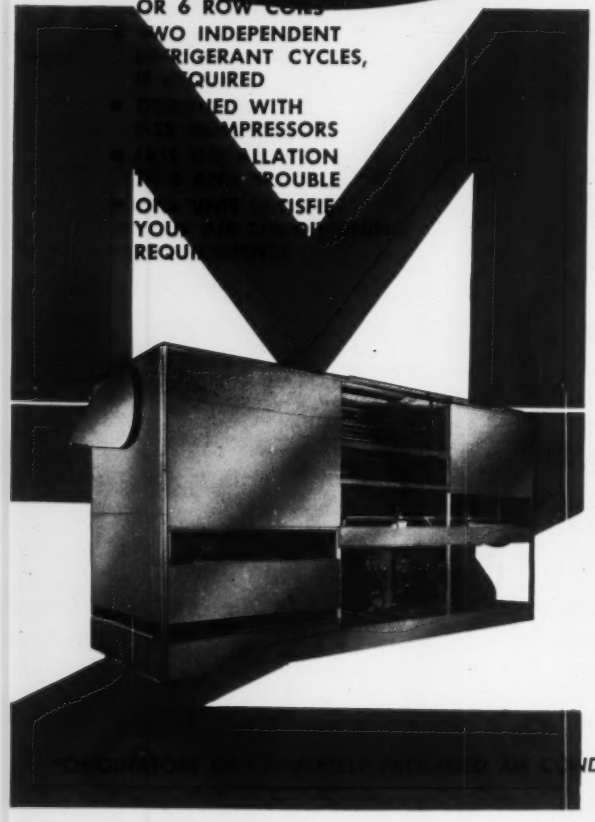
Self Contained Multi-Zone Conditioners . . . Type SCMZ

IMPORTANT FEATURES:

- EITHER 4 OR 6 ROW COILS
- TWO INDEPENDENT REFRIGERANT CYCLES, IF REQUIRED
- EQUIPPED WITH 2 COMPRESSORS
- EASY INSTALLATION
- LESS TROUBLE
- ONE UNIT SATISFIES YOUR AIR CONDITIONING REQUIREMENTS



"GOVERNAIRIZING" OF CUSTOM BUILT PACKAGED AIR CONDITIONERS"

The new SCMZ is designed for complete flexibility . . . provides the desired latitude necessary to meet the exacting requirements and unusual space limitations not available in the majority of today's mass produced, unalterable packaged conditioners.

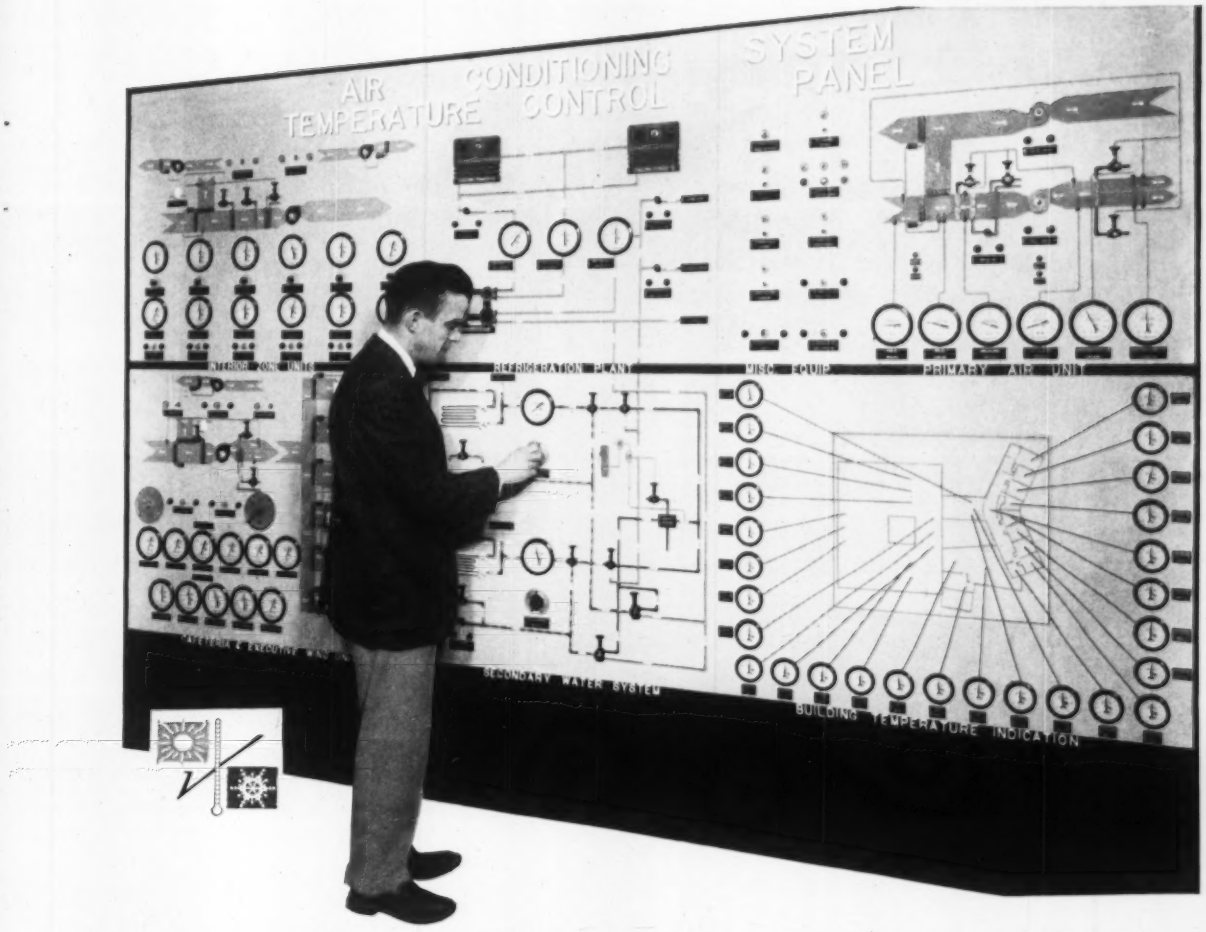
Governair's "Satisfabricated" Self Contained Units have all the basic components of a complete air conditioning system, conditioner section, compressor section, and evaporative condenser section. In these units all refrigerant piping and electrical connections are completed internally by factory-trained craftsman, and carefully supervised to assure proper operation on the job. Simple connection of duct work, electrical, make-up water and drain provide fast and economical installation.

Get Full Details Now

GOVERNAIR CORPORATION

4840 North Sewell

Oklahoma City, Oklahoma



Johnson Control Centers Set the Pace in Comfort, Simplify Air Conditioning Operations

A highlight of Guarantee Mutual Life Company's new home office in Omaha, acclaimed one of the nation's most modern buildings, is this air conditioning Control Center by Johnson.

The Center allows the engineer to supervise and operate all 10 air conditioning systems right from his office! Guiding him is a *continuous* visual display of vital data that shows at a glance the exact operating status of each system and gives him an instant check of building temperatures at strategic control points. To adjust key temperatures, he merely turns a dial! Other functions are equally easy and efficient.

The advantages of the Johnson Control Center are impressive. It simplifies an otherwise complex job, cuts fuel and power consumption, prolongs equipment life. It saves an untold amount of time. And it assures a consistently ideal working climate for Guarantee Mutual's employees.

Johnson Control Centers are now bringing similar benefits to buildings of all types and sizes. A nearby Johnson engineer will gladly supply you with complete information. Johnson Service Company, Milwaukee 1, Wisconsin. 105 Direct Branch Offices.

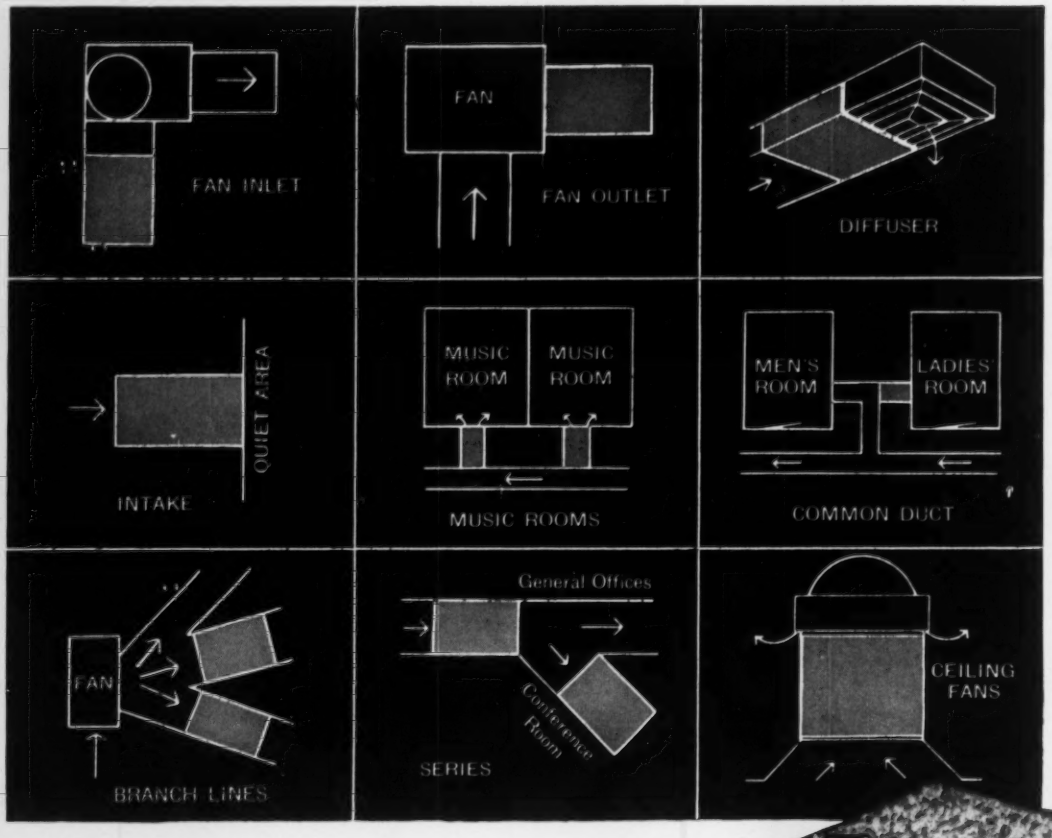
Guarantee Mutual Life Company, Omaha, Nebraska. Leo A. Daly Co., architects-engineers, Peter Kiewit Sons Co., general contractor, Natkin & Company, mechanical contractor, all of Omaha.

JOHNSON CONTROL

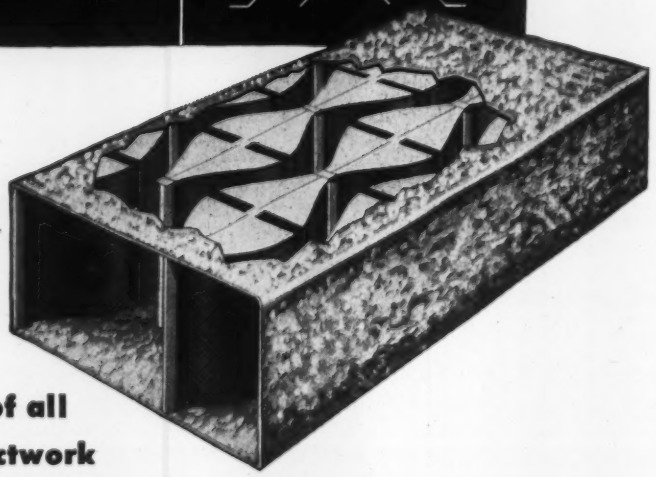
PNEUMATIC SYSTEMS

DESIGN • MANUFACTURE • INSTALLATION • SINCE 1885

TEMPERATURE CONTROL SYSTEMS FOR SCHOOLS, OFFICES, FACTORIES, STORES, HOSPITALS, HOTELS, PUBLIC BUILDINGS



Every Building Needs *Aircoustat*™ Sound Traps



AIRCOUSTAT silences all noise of all frequencies traveling through ductwork

Eliminate disturbance, distraction and irritation caused by noises escaping from one area to another through ductwork.

Install AIRCOUSTAT Sound Traps. AIRCOUSTAT eliminates guesswork, wasted space and unnecessary expense of duct lining. You can guarantee your client trouble-free performance. You can estimate with complete confidence the performance of particular applications. If AIRCOUSTAT fits geometrically, it fits acoustically.

AIRCOUSTAT saves you space. Its greater effectiveness permits smaller-sized ducting. It eliminates bulky mufflers.

For more details, write to KOPPERS COMPANY, INC., Industrial Sound Control Dept., 6210 Scott Street, Baltimore 3, Md.

KOPPERS

INDUSTRIAL SOUND CONTROL

Engineered Products Sold with ***Service***

How owners feel about an **all-copper** installation

Excitedly pleased—that's the way owners of property feel about an all-copper installation you do for them in Hussey Copper. You, too, are reassured that your copper installation will create a satisfied customer and a lasting reputation for quality workmanship. Hussey Copper gives you controlled quality from the raw ore to the finished copper product you use. It's good business-insurance to use Copper—but make sure it's Hussey Copper.

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(Division of Copper Range Co.)
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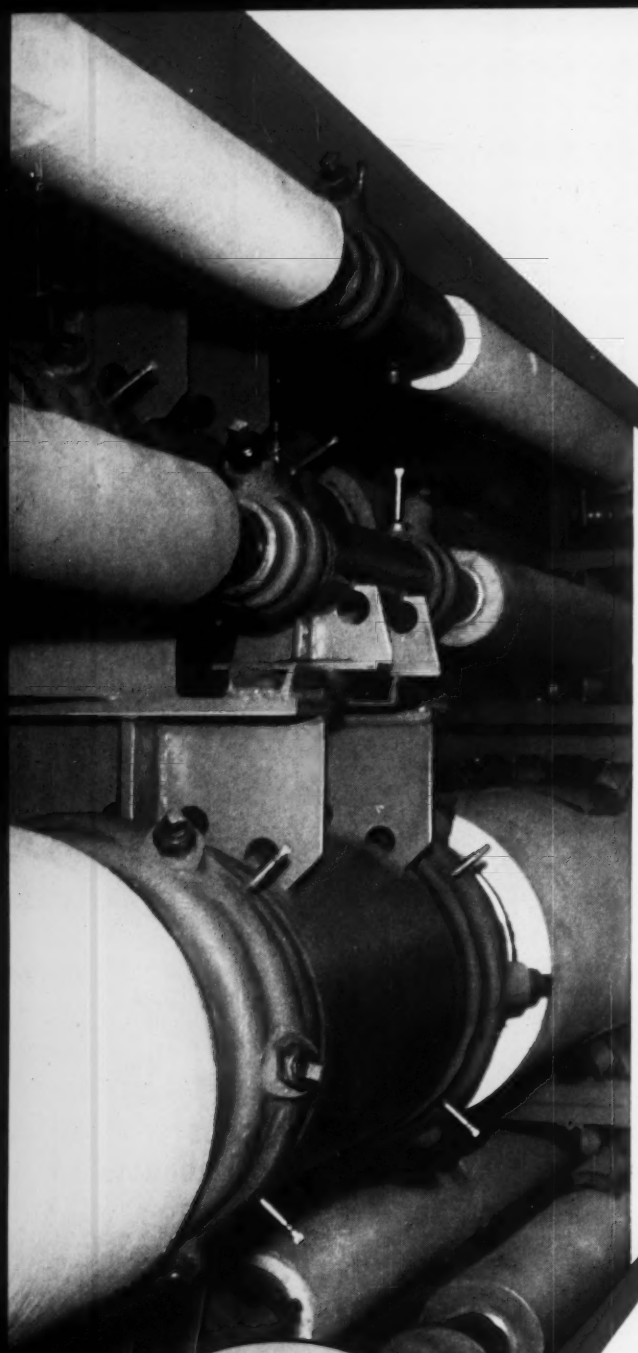
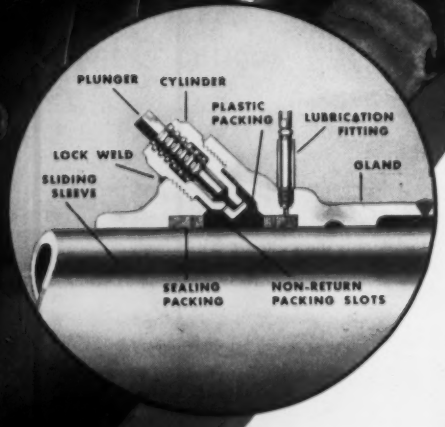


something great

has happened to steam lines..

..the improved

GUN-PAKT EXPANSION JOINT



Part of an installation of 37 new Yarway Gun-Pakt Expansion Joints at a Mid-West state institution

Details of new packing gun arrangement on Gun-Pakt Joints

With the many types of expansion joints available today for steam lines, it's important for engineers to "know their joints" when making a choice. Engineers know that Gun-Pakt maintenance costs have *always* been exceptionally low.

NOW . . . with the new Yarway Type W Gun-Pakt expansion joint you have these important *added* advantages—

CONVENIENCE— improved angle of packing guns makes them more accessible, thus reducing maintenance costs.

INCREASED STRENGTH— thanks to new one-piece integral body and gland.

LOWER MAINTENANCE— new packing gun design permits injection of special plastic packing *directly into packing space under full steam pressure. No need for costly shut-downs for repacking.*

Now is the time to find out more about Gun-Pakt joints. Write for Yarway Bulletin EJ-1916.

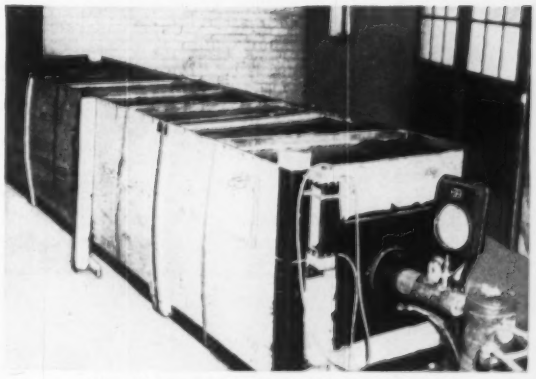
YARNALL-WARING COMPANY
107 Mermaid Avenue, Philadelphia 18, Pa.
Branch Offices in Principal Cities

GO YARWAY WITH CONFIDENCE

for users of underground piping systems...

Now... for the first time, basic principles used by RIC-WIL for decades are supported by extensive independent research. These principles are brought out in Technical Reprint #16, issued as a compilation of the results of a survey by the Building Research Advisory Board, of the National Academy of Sciences and tests made by the National Bureau of Standards. These criteria are also the basis of new Guide Specifications issued by several Federal Agencies, all of which include the basic principles of RIC-WIL Prefabricated Insulated Piping Systems. This survey is of such magnitude that it required over 2,000 man-hours and some 2,500 pages of documents and tests.

All tests of a conduit system required by the survey and specifications have been completed by RIC-WIL and an approved independent testing laboratory has certified that RIC-WIL Systems comply. Write, wire or phone for complete information.



Part of test equipment built by RIC-WIL in QUALIFICATION TEST PROGRAM.

Ask for RIC-WIL *Catalog on complete line of systems available.*

Quality Piping Systems...
... of Exceptionally High Thermal Efficiency

SINCE 1910

RIC-WIL INCORPORATED — PREFABRICATED INSULATED PIPING SYSTEMS

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See our catalog in Sweet's and Engineers' Product File

BUY FROM THESE COMPLETE LINES OF

SARCO AND SARCOTHERM

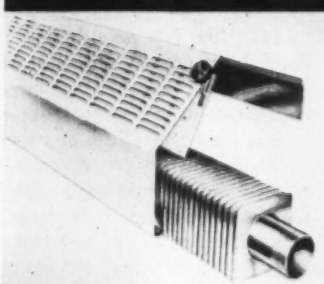
heating specialties—
and get undivided responsibility for performance

SARCO CONDENSATE AND VACUUM PUMPS

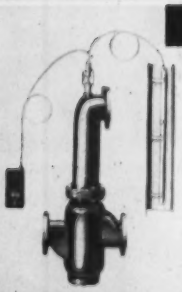
Use this one completely reliable source for

Complete weather compensated control systems . . . heating specialties . . . pumps . . . radiator traps . . . all five types of steam traps. Write for detailed catalog information.

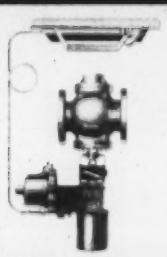
SARCOFIN FINNED-TUBE AND BASEBOARD RADIATION



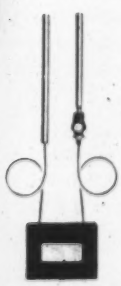
SARCOTHERM WEATHER-COMPENSATED CONTROL SYSTEMS



Modulating Controls for hot water and radiant heating



Modulating Controls for steam heating



Reset Controls for hot water and radiant heating

5895-B

SARCO · SARCOTHERM

635 Madison Avenue, New York 22, N. Y.

Location: Millville, New Jersey
Architect: Frank Grad & Son, Newark
Associate Architect: John A. Fletcher
Contractor: Benj. E. Labov & Son
Chase Wholesaler: Taylor Supply Co.

H. Ragen, Job Superintendent, reports savings of time and costs through using Chase Copper tube. At left, Granville Dunleavy makes a solder joint in one of the many lines involved in this job.

"Every man on this job swears by Chase® Copper Tube"

says Howard Ragen, Construction Superintendent on All Plumbing for Two Million Dollar New Jersey Office Building

Mr. Ragen is Job Superintendent for Benjamin E. Labov and Son, Plumbing Contractor on the multi-million dollar Tri-States Headquarters Building of The Prudential Insurance Company of America, soon to be opened.

Under his direction, more than two miles of Chase Copper water tube—from 3″ down to ⅜″ sizes—are being installed for hot and cold water supply lines, refrigeration and cooling.

Mr. Ragen says of copper tube:—
"Every man on this job swears by Chase Copper tube. Our crews are saving time, getting more feet up per working day, and getting a better installation at lower cost per foot."

Next time *you* figure a plumbing job, plan on using Chase Copper water tube. For when you figure the *total* cost—tube plus fittings plus time—you'll find *copper costs less* than rustable pipe. Copper is easier to preassemble. Joints are quicker and easier to make, cleaner, and remain pressure-tight. Long lengths need fewer connections, fewer fittings, and take less time to install and pressure-test.

Your nearest Chase wholesaler is ready to help you figure your next job with copper, so get in touch with him today. Insist on only copper tube made in U.S.A. Ask for Chase—pioneers in the use of copper water tube.

Chase®

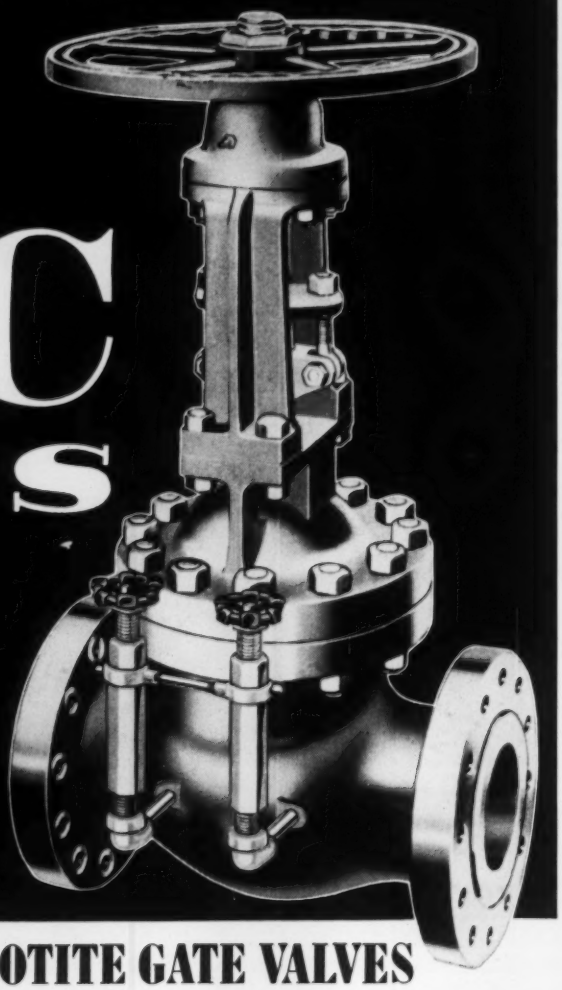
BRASS & COPPER CO.
WATERBURY 20, CONN.
Subsidiary of
Kennecott Copper Corporation

The Nation's Headquarters for Brass, Copper and Stainless Steel
Atlanta Baltimore Boston Charlotte Chicago Cincinnati Cleveland Dallas Denver Detroit Grand Rapids Houston Indianapolis Kansas City, Mo. Los Angeles Milwaukee Minneapolis Newark New Orleans New York (Maspeth, L.I.) Philadelphia Pittsburgh Providence Rochester St. Louis San Francisco Seattle Waterbury

ACCO
for Better
Values

R-P&C VALVES

THE COMPLETE LINE
—DESIGNED FOR DEPENDABILITY



R-P&C "Sure-Tight" LUBROTITE GATE VALVES

—THE MULTI-SERVICE VALVES LUBRICATED THROUGH THE SEAT RINGS

Lubrotite Gate Valves—created and patented by R-P&C—are built to provide absolute tightness and long, trouble-free service in handling all fluids for which iron and cast steel valves are serviceable.

By the unique Lubrotite system, in which each seat ring is served by a Lubrotite gun, a lubricant seal is forced through to the valve's seating surface. This lubricant prevents leakage, retards corrosion, prevents sticking, reduces wear on seating surfaces and makes for easier operation. Net result: reduced operating, maintenance and over-all valve costs!

Available in cast steel and iron types. A wide variety of lubricant seals, each suitable for numerous services, can be furnished.

Lubrotite Gate Valves are giving highly successful service in handling—

Gasoline...Oil...Benzol...HF Alkylation... other Petroleum Derivatives —

Natural and Artificial Gas...Air... Helium Gas...Coke and Gas...Water —

Vacuum Service (evaporation, etc.)... Feed Water Lines and Steam Plants —

Mine and Acid River Waters... Certain Chemicals...Other Services

Lubrotite Gate Valves form a part of the complete R-P&C line, which includes gate, globe, angle and check valves in all standard materials; all in a wide range of sizes, styles and pressure classes. Order through nearby R-P&C Distributor. Write our Reading office for catalog.

FREE WALL CHART
"How to Protect Your Valves"
Installation pointers, operating tips, clues to longer valve life. They are all on this 22" x 17" wall chart. Write for your free copy.

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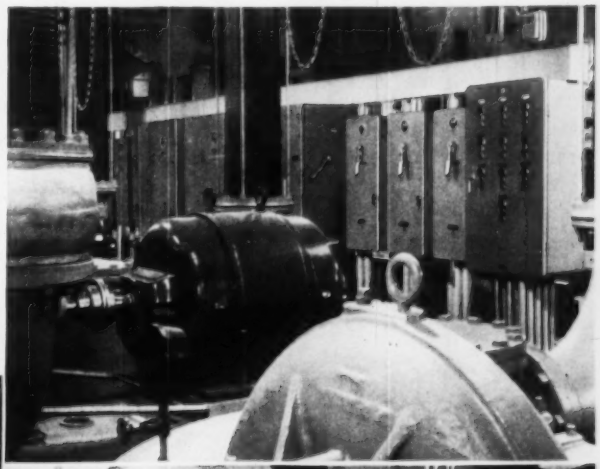
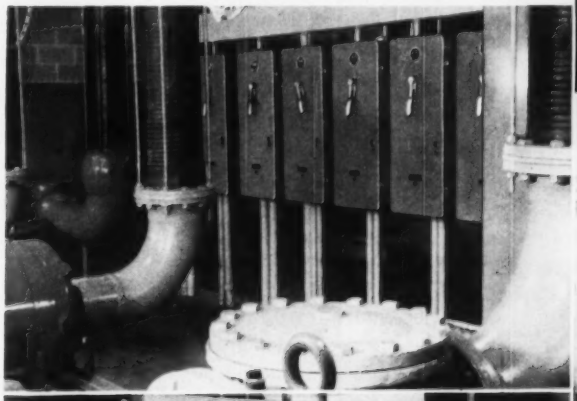
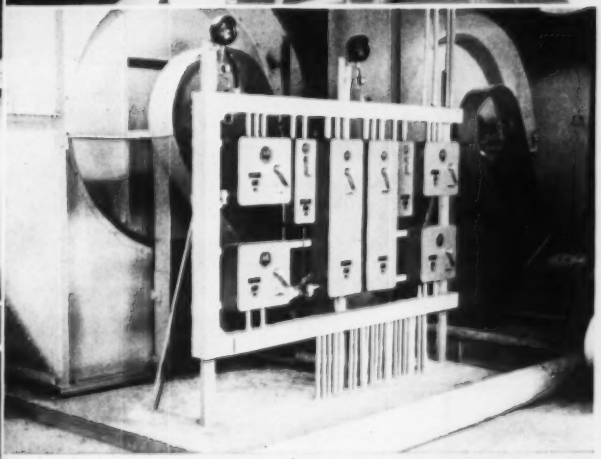


Bulletin 740 reduced voltage and Bulletin 712 combination starters for chilled water and condenser water pumps. ▶

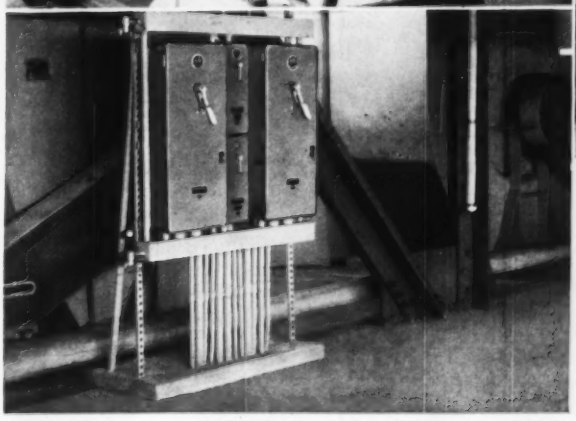


▼ Bulletin 712 combination starters for booster and condenser water pumps.



◀ Bulletin 712 combination starters, Size 1 and Size 4, mounted in fan room.

▲ This fan room control panel uses eight Bulletin 712 combination starters—including Sizes 1, 2, and 3.



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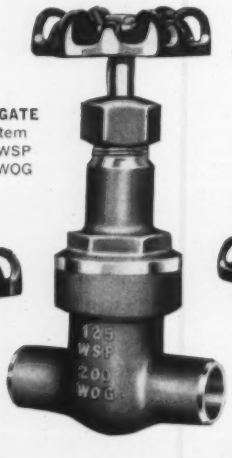

No. 2900 GATE
Rising Stem
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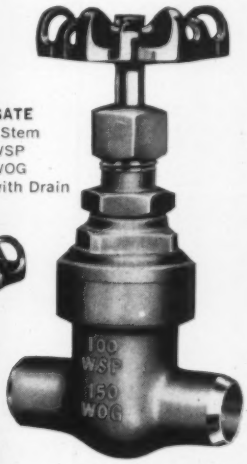
200 lbs. WOG



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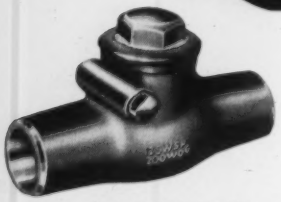

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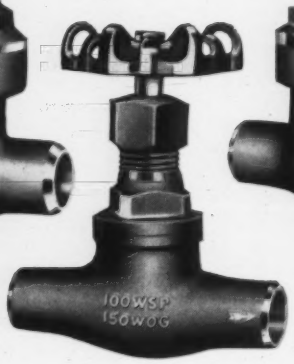

No. 601-X GLOBE
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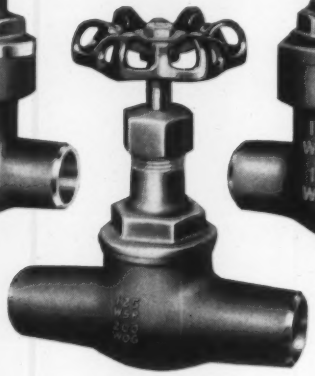

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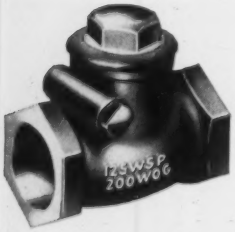
200 lbs. WOG
Composition Disc. Also
available in Angle

O-B VALVES with braze ends



No. 6606 SWING CHECK
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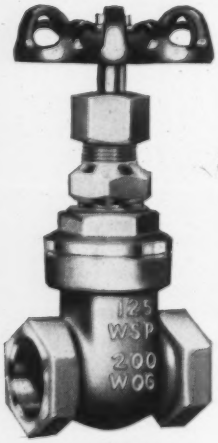
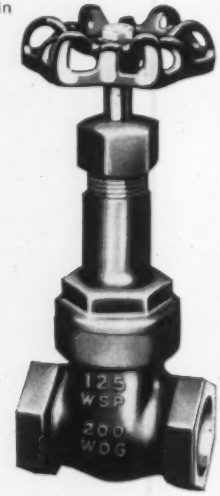
200 lbs. WOG
Brass, Composition or
Leather Discs



No. 6500 GATE
Non-Rising Stem
125 lbs. WSP
200 lbs. WOG



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FOOD PROCESS operations demand a maze of piping. Agreed. But how is sanitary piping supported? How are these supports designed and sized? Roy M. Lazar, author of the article in the March issue on the intricate Carnation Co. installation, answers these and other questions from a reader. See page 61.

What is the correct pump head for cooling tower piping? This issue's Question of the Month tells "J.A.W." how this is derived. See page 66.

The Data Sheet presents a new chart which can be used for direct sizing of round ducts quickly and easily via the static regain method. See page 107.

Construction Contracts Continue on Upswing

. . . all branches show big gains

CONSTRUCTION CONTRACTS in the U.S. in July totaled more than $3.6 billion, a gain of 24 percent over the same month of 1957, according to F. W. Dodge Corp.

The construction news and marketing firm reported that the past three months have been the highest in history, with June ranking first, July second, and May third.

According to Dodge vice president and economist Dr. George Cline Smith, the July figures have several significant features.

"For the first time this year," he said, "all three of the major branches of construction gained over the corresponding month of last year, and all the gains were substantial. The tremendous July total also helped overcome the weakness which was apparent at the beginning of the year, so that for the first time in July, the year-to-date figure is ahead of the same period of 1957 by 3 percent.

"Despite the recession earlier in the year," Dr. Smith said, "contracts now seem to be well on their way toward a new record in 1958. The recovery continues to have a very broad base, with virtually everything except business spending for commercial and factory buildings going upward.

"Among the most buoyant forces in July contracts were schools, up 20 percent above July 1957; streets and highways, up 67 percent; residential buildings, up 21 percent; public utilities, up 35 percent; public buildings, up 48 percent; social and recreational buildings, up 34 percent; religious buildings, up 22 percent; and hospitals, up 8 percent.

"Increases in apartment building contracts, up 44 percent, continue to lead the residential upturn, but contracts for one- and two-family houses also rose in July by a substantial 18 percent. The July contracts covered 121,023 dwelling units, a gain of 26 percent over July 1957, bringing the seven month total to 635,798, or 7 percent ahead of the same period last year."

According to the tabulations, contracts for nonresidential buildings in July totaled $1,076,034,000, a gain of 12 percent over July 1957.

Residential contracts amounted to $1,557,443,000, up 21 percent from July of last year.

Heavy engineering contracts, at $973,579,000, were up 49 percent from last July.

Total construction contracts for July amounted to $3,607,056,000, a gain of 24 percent over last year.

Cumulative totals for the first seven months of 1958, with percentage changes from the corresponding period of last year, were: nonresidential, $6,572,077,000, down 5 percent; residential, $8,057,400,000, up 4 percent; heavy engineering, $5,740,077,000, up 11 percent; total construction, $20,369,554,000, up 3 percent. ≠

Construction Industry Bolsters National Economy

. . . says AGC director

THE RECESSION from which the country is now emerging provides another striking demonstration of the economic bolstering power of the construction industry, James D. Marshall, executive director of the Associated General Contractors of America, said at Duluth, Minn., recently.

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"As in the recessions of 1949 and 1954, the construction industry this year has again been a bulwark of strength to a sagging economy and has helped to lead the way to recovery," Mr. Marshall told a news conference which preceded a meeting of the board of directors of the AGC of Minnesota, an association chapter.

Mr. Marshall said the total volume of all construction activity in 1957 amounted to more than $66 billion, consisting of $48.5 billion in new construction and about $18 billion in maintenance and repair work. The total of $48.5 billion for new construction represents a recent revision by the U.S. Depts. of Commerce and Labor which increased the figure by more than $1 billion from the preliminary total of $47.3 billion announced earlier.

"So far this year," Mr. Marshall continued, "the dollar volume of construction has kept pace with the record rate of last year. The total of new construction for the first six months of 1958, according to preliminary estimates by the Depts. of Commerce and Labor, amounted to $22,066,000,000, which is $8 million more than the figure for the first half of 1957."

Recovery from the recession can be further speeded, Mr. Marshall said, by placing current public and private construction projects under contract and executing them with increased vigor. The AGC official pointed out, as reasons why it is advantageous to build now, that financing is available at reasonable rates, materials are in good supply, skilled labor is plentiful and more productive, contractors' profit margins are small, and construction costs will probably continue to rise in the future.

The construction industry itself can help further to speed the upturn, Mr. Marshall said, by modernizing its plant and equipment, by insisting on realistic equipment depreciation schedules for federal taxes, by pushing local projects (such as urban renewals, schools, churches, hospitals, private residential building, highways and water and sewer facilities), and by "more resistance at the bargaining table" to keep industry prices down. ≠

ASA Approves Revisions Of Butt Welding Standards

. . . published by ASME

TWO REVISIONS of American Standards — B16.9-1958 Steel Butt Welding Fittings and B16.25-1958 Butt Welding Ends — have been approved by the American Standards Association and published by The American Society of Mechanical Engineers.

Both standards are sponsored jointly by the Mechanical Contractors Association of America, the Manufacturers Standardization Society of the Valve and Fittings Industry, and ASME.

American Standard B16.9-1958 covers overall dimensions, tolerances, and markings for wrought and cast carbon- and alloy-steel welding fittings, known as American Standard Steel Butt-Welding Fittings. The term "wrought" is used to denote fittings made of pipe, tubing, plate or forgings.

The first version of American Standard B16.9 was approved in 1940. The present revision includes fittings for use with 22 in. pipe and additional dimensions for 14 in. and larger tees and reducing tees, as well as other changes to keep the standard up to date with industry's current requirements.

American Standard B16.25-1958 covers the preparation of butt welding ends of pipe, valves, welding neck flanges, and pipe fittings. It is also applicable to other piping components which are connected into the piping system by butt welding. The standard includes requirements for re-entrant shapes for heavy wall ends, welding bevel profiles, inside contours for joints made with or without backing rings, and machining dimensions with their tolerances.

Changes in the present revision affect the specifications for welding lip design and inside contours, the explanatory notes concerning tolerances, and the nominal OD values, which are now given separately for fittings, flanges and pipe, and for cast steel valves. The revisions of this standard were coordinated with American Standard B31.1.8-1955, Gas Transmission and Distribution Piping Systems.

Copies of American Standard B16.9-1958, at $1.50 each, and of American Standard B16.25-1958, at $1.00 each, are available from American Standards Association, 70 E. 45th St., New York 17, or from The American Society of Mechanical Engineers, 29 W. 39th St., New York 18. ≠

Gas Sales to Industries Show 4.1 Percent Gain

. . . AGA reports

THE GAS UTILITY and pipeline industry's June sales to industrial consumers showed a substantial gain for the second consecutive month, despite the slackened pace of the nation's industrial production.

The American Gas Association reports that June industrial gas sales of 3541 million therms represents a 4.1 percent increase over the amount sold in June a year ago. Industrial production, as measured by the Federal Reserve Board index, was down 10.3 percent from June 1957. ≠

"Quote"

"A good executive has a worried look on his assistant's face." — *W. L. Long, at the 12th annual convention of the Refrigeration and Air Conditioning Contractors Association.*

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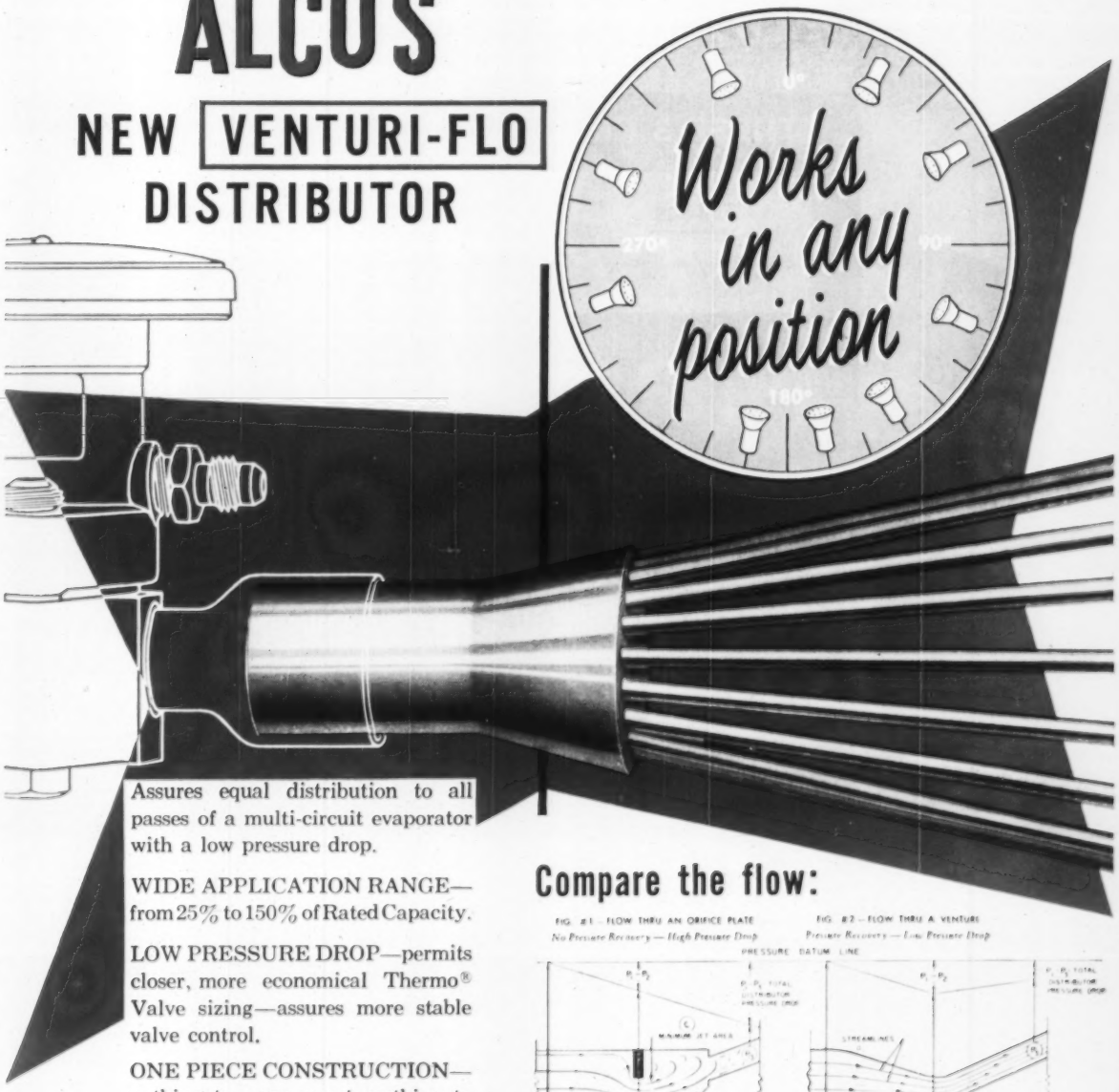

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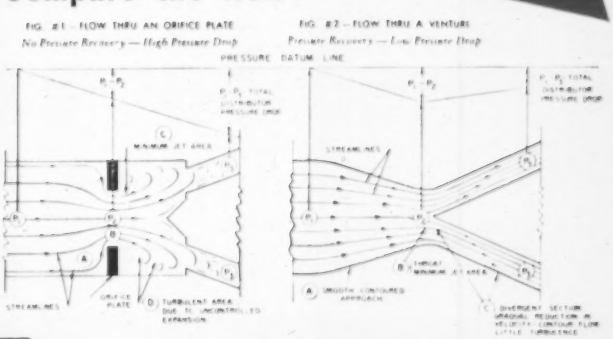
FIG. #1 – FLOW THRU AN ORIFICE PLATE
No Pressure Recovery — High Pressure Drop
FIG. #2 – FLOW THRU A VENTURI
Pressure Recovery — Low Pressure Drop
PRESSURE DATUM LINE
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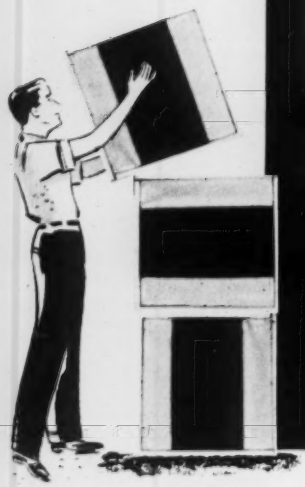

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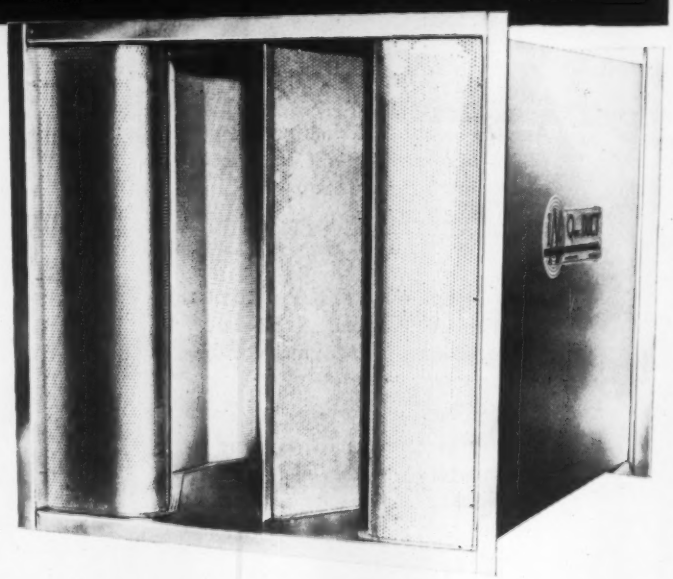

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"Open for Discussion"

• *WE FOLLOW HERE each month the practice at engineering society meetings of providing an "open for discussion" period. You are urged to take part: Just address your comments to the Editors, Heating, Piping & Air Conditioning, 6 N. Michigan Ave., Chicago 2.*

Request More Installation Details On Milk Process Piping System

ROY M. LAZAR'S article *Food Process Operations Demand Maze of Piping* (March) is a very interesting description of food process piping. I only wish he had gone into more detail about some of the features of the installation: the supports for sanitary piping; how these supports were sized and supported, etc.; the design of angle iron and rod hangers; experience in other plants on nonlubricated compressors, ring life, carbon dust, etc.; and more details on the features of the various controls.

A. C. KIRKWOOD
A. C. Kirkwood & Associates
Consulting Engineers
Kansas City, Mo.

THE AUTHOR'S REPLY — The following are my answers to the questions asked by Mr. Kirkwood:

Supports for sanitary piping: In the design of the supporting network for the sanitary piping we follow a few standard procedures which have been developed through experience.

What we strive for is to make the installation of the sanitary piping as convenient as possible for the operating personnel to clean and maintain. When you consider that this pipe in many instances has to be broken down and removed from its hangers and washed and placed back again each day, it certainly is important that the design of the system be tailored to make this operation as easy as possible.

As each piece of pipe is separately cut and installed on a job when it is removed from its position and cleaned, it must be returned to its original position for proper installation. Even though several links of pipe may be similar, it may be difficult to return these pieces of pipe to any other position except the one for which it was specifically made originally.

This is the reason we support all individual pieces of pipes by hooks at both ends. By this method the plant personnel can unscrew the union joints at each end, take the pipe down, wash it, and replace it in its original place without having to bother any adjacent piping. The adjacent piping is supported in the same manner. The hooks that are used for supporting this pipe are open ended so that there are no thumb screws nor connections to loosen when taking the piping out of its support. It merely rests in the open hook.

We usually place the highest lines approximately 7 ft, 3 in. above floor level. Then, our lowest overhead lines are normally 6 ft, 3 in. These elevations permit people of average height to walk beneath the lines without ducking and without having to stand on something to reach the highest lines for dismantling. Then, the actual hanger pipe to which the hooks are attached for support are placed approximately 12 in. above the highest piping supported.

We have standardized on using 2 in. stainless steel pipe for the hangers. This is because the more common sanitary line sizes in our plant are 2 in.

As our processing rooms have high ceilings, it is inconvenient to support the hanger pipe from them. We, therefore, place floor stands directly under the hanger pipe at approximately 10 ft intervals. We use the 10 ft interval on spacing as it gives us a rigid hanger piping system. If piping is near a wall it is, of course, supported from the wall.

The shape of the sanitary pipe supporting hook follows very closely the shape of hooks as made by manufacturers of sanitary piping fittings. These hooks are welded to the hanger pipe.

On some installations we use black iron pipe for hanger supports. This is 1¼ in. Schedule 40 pipe, as this very nearly matches the OD of the 2 in. sanitary tubing. It is rather difficult to explain in words how the sanitary pipe, hooks, and the hanger pipe are installed without referring to a drawing. However, I believe reference to the cover picture of the March issue and to the picture on page 103 of that issue will help clarify the description.

Design of angle iron and rod hangers: This type of hanger is used for all other piping throughout the plant except where an individual line is supported. All other piping is run together in banks to simplify installation and reduce the number of hangers required. These hangers are fabricated from angle iron and are supported from the overhead structure by rods at each end. This is the normal trapeze type hanger. In many instances where hangers are quite long, additional rods are placed in the center or at several other points between the end rods.

Hangers are spaced on a maximum of 10 ft centers.

We use this as a standard spacing, as hangers so arranged will accommodate many different pipe sizes. The smallest size to be accommodated that we use is ½ in. Therefore, with a maximum of 10 ft spacing on the hangers, the deflection on the ½ in. pipe is not excessive. Also, with hangers spaced this close together it is convenient for a man to get up onto a bank of piping (where the line sizes are not too small) and be supported. The size of the angle iron used for these trapeze hangers is based upon dead weight only.

One thing that is very important in this type of pipe hanging system is that no piping subject to expansion and contraction be attached directly to the hangers. These lines can be guided when necessary, without fastening to the hanger.

The sheet metal saddles placed between the angle iron hanger and pipe insulation is normally made up of 14 gage galvanized iron. These wrap around the bottom half of the pipe, and are normally made approximately 12 in. long. These work satisfactorily on all of our normal sized piping which very seldom is larger than 8 in.

With this type of support, where the weight of the pipe is bearing through the insulation, it is necessary to have an insulating material which has very good bearing strength. There are a number of good insulations on the market that have good bearing strength for both hot and cold applications. We like this method because the pipe supports are completely isolated from either the hot or cold surface of the piping.

Nonlubricated compressors: We have used nonlubricated compressors in many of our plants throughout the country. Because of Mr. Kirkwood's question concerning their life, etc., I have made several inquiries to different plants.

Our main reason for using nonlubricated compressors is to provide an oilfree air supply. This is a must where air is introduced for agitating milk. Oil vapor must not be permitted to condense in the milk.

This air is also used for all critical instruments and for the air conditioning controls. By critical instruments I refer to all instruments of the industrial type. The other instruments, which we term the commercial type, are normally run by air supplied by a conventional type of air compressor.

We normally have our plant personnel inspect the rings on nonlubricated compressors after the first 1000 hours of operation. Inspection at this time will then indicate when successive inspections are necessary for possible replacement. The average life of the carbon rings, I find, normally runs approximately 5000 hours before replacement is required.

I have not run into any instance where carbon dust is a problem.

All of our experience to date has been with compressors no larger than 3 hp.

Automatic controls: Comments on the automatic controls as used in this plant are going to be confined to those as mentioned in the original article. There are a variety of controls, of course, used in a plant of this size. However, the majority of these apply to processing and are beyond the scope of the original article. I will, therefore, further clarify the control system used for the chilled water and tower water systems of the plant as mentioned in the article.

The control systems for both tower water and chilled water function in exactly the same manner.

There are a number of loads supplied from these systems, some fixed and some variable. All of these loads are not necessarily on at the same time, and load variation in the plant may vary from zero to 100 percent.

Water for this system is supplied by three pumps. With all three on the line, the 100 percent load requirement is balanced. No pumps on the line corresponds to zero percent. Therefore each pump can satisfy one-third of a load requirement. Each pump is of the same capacity.

As the load may fluctuate rapidly and without any preset pattern, it is impractical to expect an operator to make the most efficient use of his pumping capacity by manually starting and stopping the pumps. Therefore we use an automatic controller to accomplish this.

A pressure controller is used as the basis of sensing load variations. This pressure controller is set to maintain an operating dicharge pressure of the pumps of between 70 and 75 psi. The controller used is of the modulating type. As load variations will not necessarily exactly coincide with the full load capacity of each pump variation (zero, 1/3, 2/3, and 1), it is necessary to use a means of satisfying any load between the points of zero to 1/3, 1/3 to 2/3, and 2/3 to 1.

This is accomplished with the use of a bypass valve which can bypass the capacity of one pump; that is, 1/3 of total load. This bypass is between the supply and return headers. The valve is a modulating type and its position is determined by the pressure controller being fully stroked by the 5 psi variation in supply pressure being maintained. This, in effect, gives an infinite number of steps provided by the supply pumps to meet any load requirement.

With a constant supply pressure being maintained, it is very simple then to balance the varying heat exchange loads in the plant. And, of course, with the supply pressure being maintained automatically, balance is always assured.

There is one point I should have mentioned previously in regard to the bypass control which is used to supply increments of capacity between pump stages. If this were not used, there would have been no way of preventing the pumps from cycling without going to an impractically large pressure variation in the supply main.

ROY M. LAZAR
Chief Mechanical Engineer
Carnation Co.
Los Angeles, Calif.

"Conditioning Compressed Air" Article Valuable Tool to Designers, Users

THE ARTICLES, *Here Are Fundamentals of Conditioning Compressed Air* (July) and *Increase Compressed Air Efficiency Through Mechanical Refrigeration* (August), by Frank D. Ross, comprise a well organized presentation of facts as applied to compressed air. The discussion is worthy of careful study by all who are responsible for the design, installation, and operation of compressed air machinery and equipment. This observation applies equally to compressed air distribution systems.

Mr. Ross has spotlighted many important facts that must be considered if air compressor stations are to perform satisfactorily. He has, for example, stressed the need for good air filtration as a protection against damage that often is the cause of badly damaged machinery. Some years ago, I was called to report on a badly damaged two stage air compressor that was directly connected to a 150 hp synchronous motor. Both the high and low pressure cylinders had been so badly cut and scored by airborne dirt, dust, and sawdust that entered both the high and low pressure cylinders that each cylinder had to be rebored and fitted with a complete set of new valves—a most costly operation.

Mr. Ross is on safe ground also when he discusses the use of refrigeration as a cooling medium for air compressors and air systems generally.

Back in the days when the ice industry began turning from distilled water ice to raw water ice, some means had to be developed for removing moisture from the air used to agitate the water being frozen. A review of this development of some 35 to 40 years ago suggests that much of the work done by the early pioneers in this field and the resulting data could be most useful if applied in the modern air compressor stations of today.

The author of the article in question is to be congratulated on a job well done.

C. T. BAKER
Consulting Engineer
Atlanta, Ga.

Disagree with HT-HPHW Article On Limits, Advantages, pH of Water

REGARDING the article *High Temperature-High Pressure Hot Water Heating Must be Understood* (August) I should like to make the following comments:

We at J. O. Ross Engineering do not agree with the definition of high temperature-high pressure hot water which limits its range to 300 to 400 F. In the central high temperature hot water system at the U.S. Air Force Academy in Colorado Springs, which I have designed, we went as high as 450 F.

In the article, H. A. Lockhart claims, as one of the principal advantages of a high temperature-high pressure hot water system, its ability to produce power from the system by its transfer to steam. In actual fact, while technically feasible, this method is used only in atomic power stations which Mr. Lockhart excludes by his definition of high temperature-high pressure hot water systems.

When heat and power generation are combined, such as in the plant which we have conceived and designed for the Ernest Harmon Air Force Base in Stevenville, Newfoundland, high pressure steam is generated in the boiler and expanded first in extraction or back pressure turbines for power generation before being used in the high pressure-high temperature hot water heat distribution system. In other words, in combined heat and power production, power comes first and the heat distribution afterwards.

Another statement that we disagree with concerns the water treatment. It is stated that the pH of the water should never exceed 9. For many of our installations we prescribe a pH of 9 to 9.5, while in others we demand 8.5 to 9. It depends entirely on the type of system, the materials in the system, and the water analysis.

E. G. HANSEN
J. O. Ross Engineering Div.
Midland-Ross Corp.
New York, N.Y.

EDITORS' NOTE — The article referred to by Mr. Hansen in his comments was actually a report of what Mr. Lockhart presented in his discussion on the need for understanding all the features of high temperature-high pressure hot water heating systems at the recent convention of the Mechanical Contractors Association of America in Los Angeles.

Mr. Lockhart did not stress the temperature limitations in his presentation. It is commonly understood there really are no fixed limits — only those that are more or less established by common practice. Likewise, the comments on the other points may be considered in the area of installation practices.

Chicago Hospital's Air Conditioning Design Based on Other Assumptions

THE ARTICLE *Design New Hospital Heating, Air Conditioning for Expansion* (June), by William Sturm, is of special interest to me, as our hospital, Presbyterian-St. Luke's of Chicago, is just completing a 480 bed addition.

In the preliminary design stage we explored the various types of air conditioning systems. Our studies developed the following conclusions, which differ considerably from the article:

1) That dewpoint control with reheat system would give the most satisfactory results, but it was likewise the most costly to install. Consequently, it was used only in areas with unusual air conditioning problems and not in patient rooms.

2) That dewpoint control with reheat is the most costly to operate because of the low refrigeration level necessary and the simultaneous use of steam.

3) That the maintenance problems of a duct reheat system could be extensive because of the probable coil locations in furred-down ceiling spaces as opposed to room units where the controls are at "an under window stool location."

4) That the use of a low velocity air distribution system from a central basement or top floor apparatus meant considerable floor area devoted to ducts which can be quite expensive at today's building cost.

5) That surgery, delivery rooms, and the nursery require the maximum air filtration and that recovery rooms would be treated as patient rooms.

These basic assumptions vary considerably from the Asbury Hospital. The author undoubtedly had very good economic and operational reasons for selecting the systems he used.

It would be interesting to those of us in the hospital field to have the author discuss some of the system selection problems that were encountered on this project.

Mr. Sturm should be complimented for his comprehensive treatment of the project.

JOHN HOLBROOK
Administrative Engineer
Presbyterian-St. Lukes Hospital
Chicago, Ill.

Terminology Should Be Descriptive To Inform Both Engineer, Layman

I HAVE BEEN interested in the comments which have appeared in the "Open for Discussion" pages discussing a more suitable term for high temperature hot water.

In the July issue, E. G. Hansen takes issue with Erik B. J. Roos and discards the suggested term of *high temperature water* or *high temperature hot water*, advocating the term *high pressure hot water*.

Copperad, Ltd. has been manufacturing space heating equipment for high temperature water applications since the early 1930's, and this form of space heating has been extremely popular here in Great Britain ever since. Currently, a considerable proportion of the new larger space heating schemes which are designed operate on high temperature hot water.

The question of a suitable term has frequently been discussed, and the common terms used in England are:

High temperature hot water (over 260 F)
Medium temperature hot water (between 200 and 260 F)
Low temperature hot water (200 F and under)
(All these are flow temperatures.)

Mr. Hansen suggests that, to be successful, terminology should be designed for the layman. This in preference to terminology which is clear only to the engineer.

I would like to go further than this and suggest that such technical descriptions or abbreviations should be as fully descriptive in themselves as possible. Both the engineer and the layman would then be fully informed. Also, terms should not be ambiguous.

The term suggested by Mr. Hansen—*high pressure hot water*—is, unfortunately, ambiguous in that every engineer and probably most laymen know that one can have water at any pressure he wishes and at any temperature he wishes, providing the pressure exceeds the steam pressure for the corresponding temperature. Thus, one could have water at, say, 100 F, but pressurized to say 200 psi. Thus, the term *HPHW* gives no clue as to the operating temperature.

In our considerable experience, therefore, the terms which I have listed seem to be the most descriptive and the least ambiguous. I would however agree with Mr. Roos that the word *hot* is superfluous, and I would suggest that possibly it could usefully be deleted except from the point of view of common usage.

E. B. T. TANNER
Managing Director
Copperad, Ltd.
London, England

Don't Step Out of Your Class; Let a Professional Do the Job

THE AUGUST Question of the Month presented answers to the question, *What's Best Way to Set Up Technical Reference Library?*

Following the precept that it's best to use a professional to do a professional job, I would say the best way to set up a technical reference library is to hire a professional librarian to do the job. Such persons are skilled in the art of acquiring, organizing, and putting technical information to use.

The Special Libraries Association, 31 E. 10th St., New York City, maintains a consultant service committee which administers a professional consultation program. This service offers a free one-day consultation with organizations seriously interested in inaugurating library service or organizing information in most of the industrial areas in the United States.

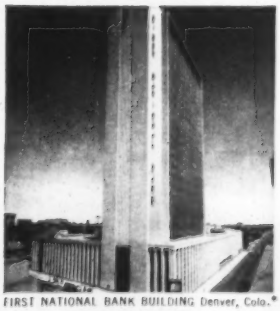
One important consideration is that the system used to organize technical literature should not be too limited nor over sophisticated. The free booklet, *Non-Conventional Technical Information Systems in Current Use*, issued by the Office of Scientific Information, National Science Foundation, Washington 25, D.C., briefly describes systems used for handling internal research reports in 24 organizations. Some of these systems are quite elaborate, requiring the use of electronic computing machines. Others are quite simple.

The new book, *Punched Cards and Related Devices: Their Applications in Documentation*, edited by R. S. Casey and others, will be published in the near future by Reinhold Publishing Co. and should contain very important detailed information.

Technical information is a perishable commodity; it should be used promptly, willingly, and completely.

EUGENE B. JACKSON
Librarian
Research Staff
General Motors Corp.
Detroit, Mich.

Top heating performance by RECO atop the mile high city!



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Going up! This seven-ton RECO tank recently climbed 28 stories to a permanent spot on top of Denver's First National Bank Building. Now it is there to stay. This copper-lined hydropneumatic storage tank is typical of all RECO engineered products – including the copper-silicon generators, pressure tanks, and heaters which were installed at First National in less spectacular fashion.

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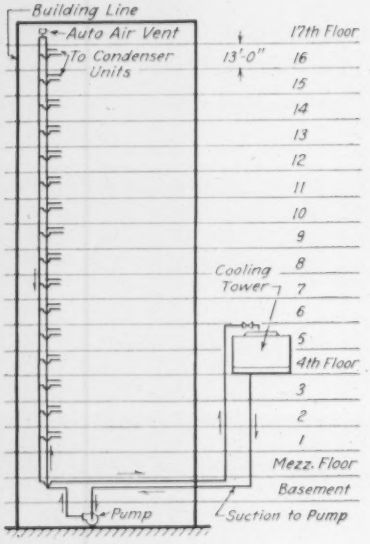
Question of the Month

What Is Correct Pump Head For Cooling Tower Piping?

This question was asked previously in Heating, Piping & Air Conditioning and is repeated here, along with answers that have been received from readers. Other answers or comments for publication are invited.

"I have a problem of accurately determining the pump head for the piping system where cooling water is pumped from a subbasement to condenser units on all of 16 stories and then to a cooling tower which has the water inlet on the fifth story level. See the drawing below.



I would appreciate any suggestions that others may have on how this problem may be solved."—J.A.W.

Head Depends on Size of Piping, Velocity of Water Through It

ALMOST ALL of the head developed in this problem will depend upon the size of the piping and the velocity of the water going through it. So the first thing to do is determine the amount of water to be supplied and, with the aid of the ASHAE Guide, make a tentative layout to secure a moderate pressure drop.

After this is done the total head against which the pump will work will be the sum of: (1) head necessary to overcome friction of water in piping; (2) pressure drop in valves and fittings; (3) pressure drop in farthest condenser and fittings; (4) head required in cooling tower discharge; (5) entrance loss at cooling tower sump; and (6) hydrostatic head in piping between sump level of cooling tower and spray height.

Because the hydrostatic head in the risers opposes the flow of water in the supply lines and assists the flow in the return, the algebraic sum of the hydrostatic head is zero and can be neglected. This is also true of the risers to the cooling tower, except for the hydrostatic head in the piping between the sump level of the cooling tower and spray height.

It may be well to point out that check valves ought to be placed in the supply riser and solenoid valves in the return line so that the weight of the water will not force water out into the cooling tower's sump when the system is shut off. This could happen even with an airtight system. If the system is not airtight the drop will be much greater.

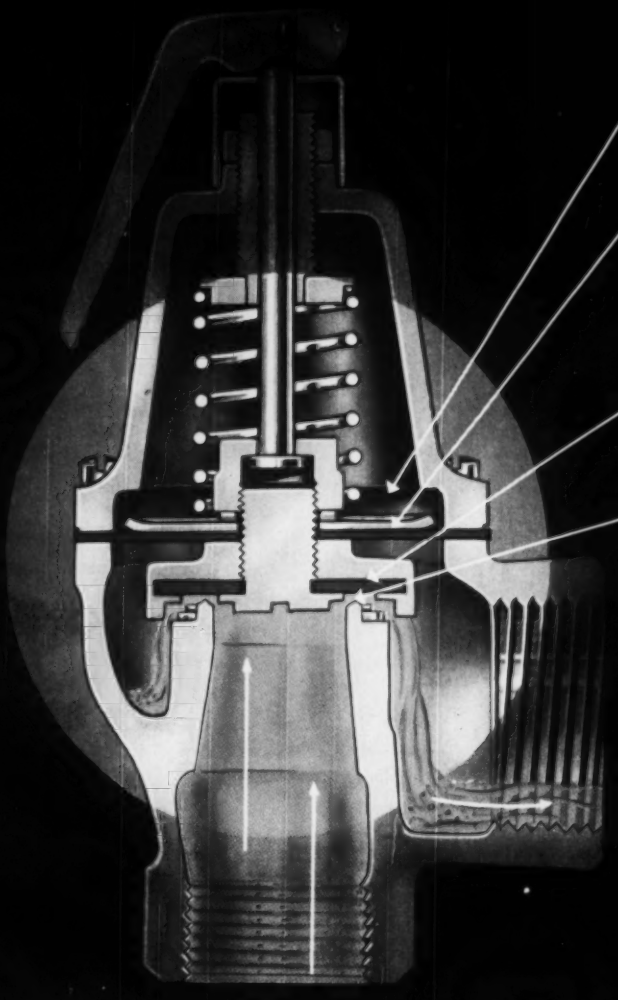
JOHN BELUNAS
Mechanical Engineer
Brooklyn, N.Y.

All That Is Needed Is Check Valve, Friction Loss, Defined Pumping Head

THE DEFINITION now accepted by the cooling tower industry for *pumping head*, according to the newly published Cooling Tower Institute bulletin NCL-109, is as follows:

Total pumping head—The total head of water,

WHAT DO YOU LOOK FOR IN ASME PRESSURE SAFETY RELIEF VALVES?



Double-Safe Design — No mechanical guides—not diaphragm operated.

Water Seal — Provides precise alignment of seal to disc and eliminates need of hazardous mechanical guides which can stick or freeze a valve shut from lime or corrosion. Seal also protects spring working parts from water or steam during relief.

Stickage-free Disc-to-Metal Seating — heat resisting, stickage-proof silicone disc material.

Pop Action Operation—All Watts A.S.M.E. rated relief valves operate by pressure exerted directly against the disc to pop the valve wide open for steam relief. The full rate of discharge is immediately reached at the set opening pressure and does not depend on further pressure accumulation as in some other designs.

ENGINEERING DESIGN

The most advanced design in A.S.M.E. rated pressure relief protection for hot water boilers is the new *Double-Safe* design of Watts Valves.

These are water pressure relief valves with an *emergency* steam rated pressure safety relief feature. They will discharge excessive water pressure created by thermal expansion and also excessive steam pressure in the event of emergency temperature conditions.

FULL SELECTION OF SIZES

Watts offers the most complete line of boiler safety relief valves with the 174A Series and 74A-740 (expanded outlet) Series. Designed to meet the smallest or largest requirements for pressure protection from one line of valves, Watts A.S.M.E. Rated Relief Valves furnish complete protection for the great majority of hot water heating and supply boilers *with a single valve.*

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Watts A.S.M.E. Rated Pressure Relief Valves are available in capacities from 500,000 BTU/HR to 14,370,000 BTU/HR with valve settings from 30 to 150 lbs.

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Protection and Control Specialties

For complete Specifications,

Ratings, and Application Information on Watts A.S.M.E. Rated Valves, see your wholesaler or send for Bulletin F-ASME.

measured above the basin curb, that is required to deliver the circulating water through the distribution system.

Tower pumping head—That part of the *total pumping head* for which the design of the tower and the piping furnished with it are responsible. It is expressed as the head of water above the basin curb measured at the center of the inlet connecting the tower distribution system with the riser, and consists of the total pressure at the centerline of the inlet plus the vertical distance between the inlet centerline and the basin curb.

Maybe all J.A.W. needs is a check valve and a means of calculating his friction loss in the system, plus the total pumping head including the tower pumping head, as we have defined it.

RAYMOND C. KELLY
Executive Manager
Cooling Tower Institute
Palo Alto, Calif.

Reverse Return System Preferred, Since It Facilitates Balancing

THE PIPING arrangement shown at the right is preferable to the one shown in the original problem. The reverse return system illustrated here has the advantage of facilitating the balance of pressure drops across the various branches. With the simple two-pipe system, the branches supplying water to the lower floors will take most of the flow at the expense of the branches in the upper floors. If the system involved is not installed yet, it will be advisable for J.A.W. to use the reverse return system suggested.

If the piping represented a closed system, the total head across the pump would be equal to the total friction losses. However, this being an open system, the following is submitted for consideration:

$$\text{Suction head} = h_s - h_{fs} - h_{vs}$$

and

$$\text{Discharge head} = h_c + h_t - h_{vd} + h_{fd}$$

where:

h_s = static head at pump suction, ft
h_{fs} = friction drop in suction piping, ft
h_{vs} = velocity head in suction piping, ft
= (suction velocity in ft per sec²)/64.4
h_c = desirable delivery pressure at cooling tower, ft
h_t = head lift to cooling tower, ft
h_{vd} = velocity head in discharge piping, ft
= (discharge velocity in ft per sec²)/64.4
h_{fd} = friction drop in discharge piping, ft

$$\text{Total delivery head} = (h_c + h_t - h_{vd} + h_{fd}) - (h_s - h_{fs} - h_{vs})$$
$$= (h_t - h_s) + (h_{fd} + h_{fs}) + h_c + (h_{vs} - h_{vd})$$
$$= h_d + h_f + h_c + (h_{vs} - h_{vd})$$

where:

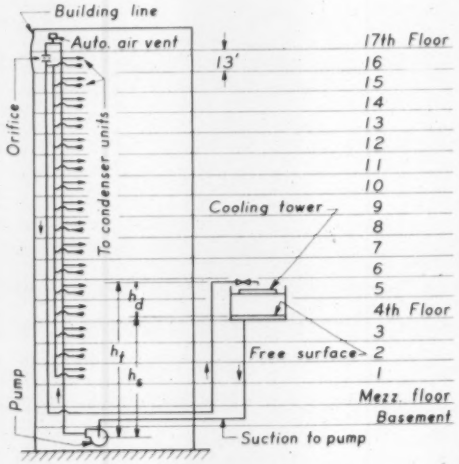
$$h_d = h_t - h_s$$

and

h_f = total friction losses in the system.

The pump may now be selected for the required flow.

If the branches are well balanced, h_f may be computed by ordinary methods involving any one of the



branches and the main lines. If there is an undesirable residual unbalance, balancing valves may be used at selected branches, so that the flow may be well apportioned throughout the system.

ANTONIO DI LORENZO
Engineer
Brooklyn, N.Y.

READER ASKS—

"How Can I Figure Supports for Horizontal Tank?"

"How should I design the supports for a horizontal tank, 10 ft, 10 in. in diameter × 50 ft long?

"The vessel has been fabricated from ¼ in. thick steel plate and has dished heads. The tank is to be used for ammonia absorption and will be filled with water. The operating pressure will be 25 psi. The tank will be supported by concrete saddles.

"How far apart should I place the saddles. How many saddles should I use, without placing undue stresses on the shell?"—R.W.G.

• *YOU ARE INVITED to contribute a question for publication, or an answer to a published question. Please address your reply to the Editors, Heating, Piping & Air Conditioning, 6 N. Michigan Ave., Chicago 2.*

There's a trend to

WELDED PIPING IN SMALL SIZES, TOO

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...because it PAYS
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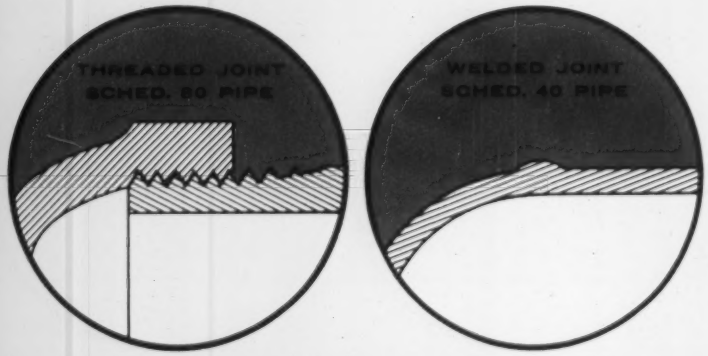
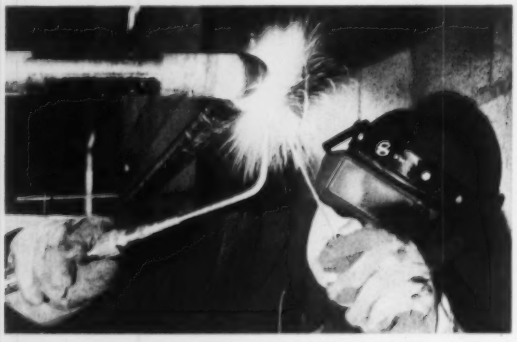
In small sizes . . . all sizes . . .

welded piping with TUBE-TURN FITTINGS pays off 3 ways!



SAVES ON MATERIAL. Schedule 40 pipe, butt welded, is stronger in bending and fatigue and has greater thickness for corrosion resistance than Schedule 80, threaded. Hence, welding piping can be lighter . . . can cut material costs 30-50%.



SAVES ON INSTALLATION. Butt welded joints in 1½" piping, such as school heating line shown, averages 7 minutes compared to 8 minutes for threading and tightening fitting. Tools are simple, inexpensive.

MORE INFORMATION—"The Economics of Welding Small, Non-critical Pipe" gives helpful information. Mail the coupon for your free copy.

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SAVES ON MAINTENANCE. Butt welded joints are permanently as strong and leakproof as the pipe itself. Photo shows ½" welded water-heat piping for shopping center . . . specified to eliminate maintenance expense.

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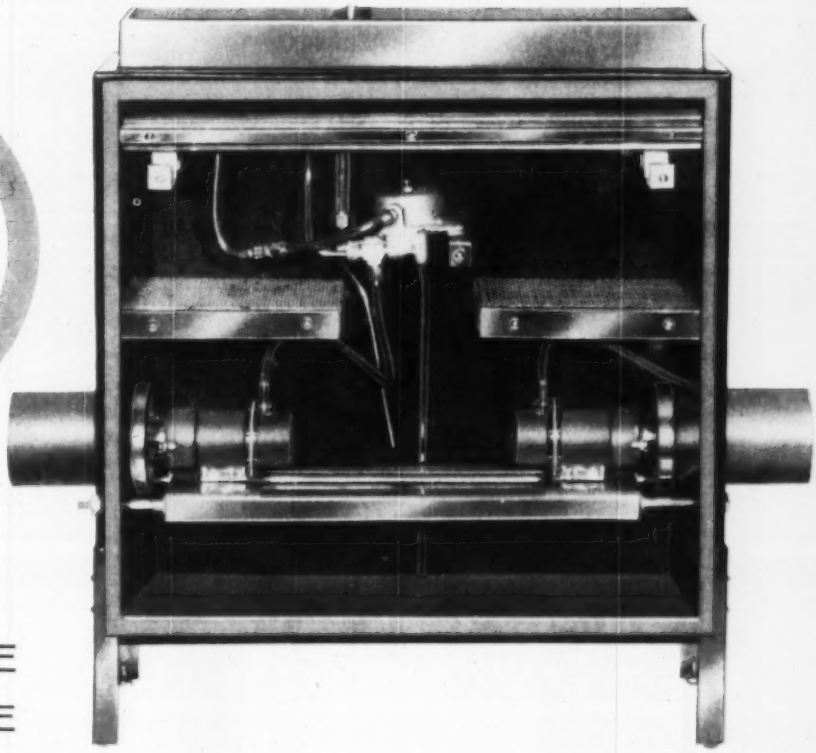

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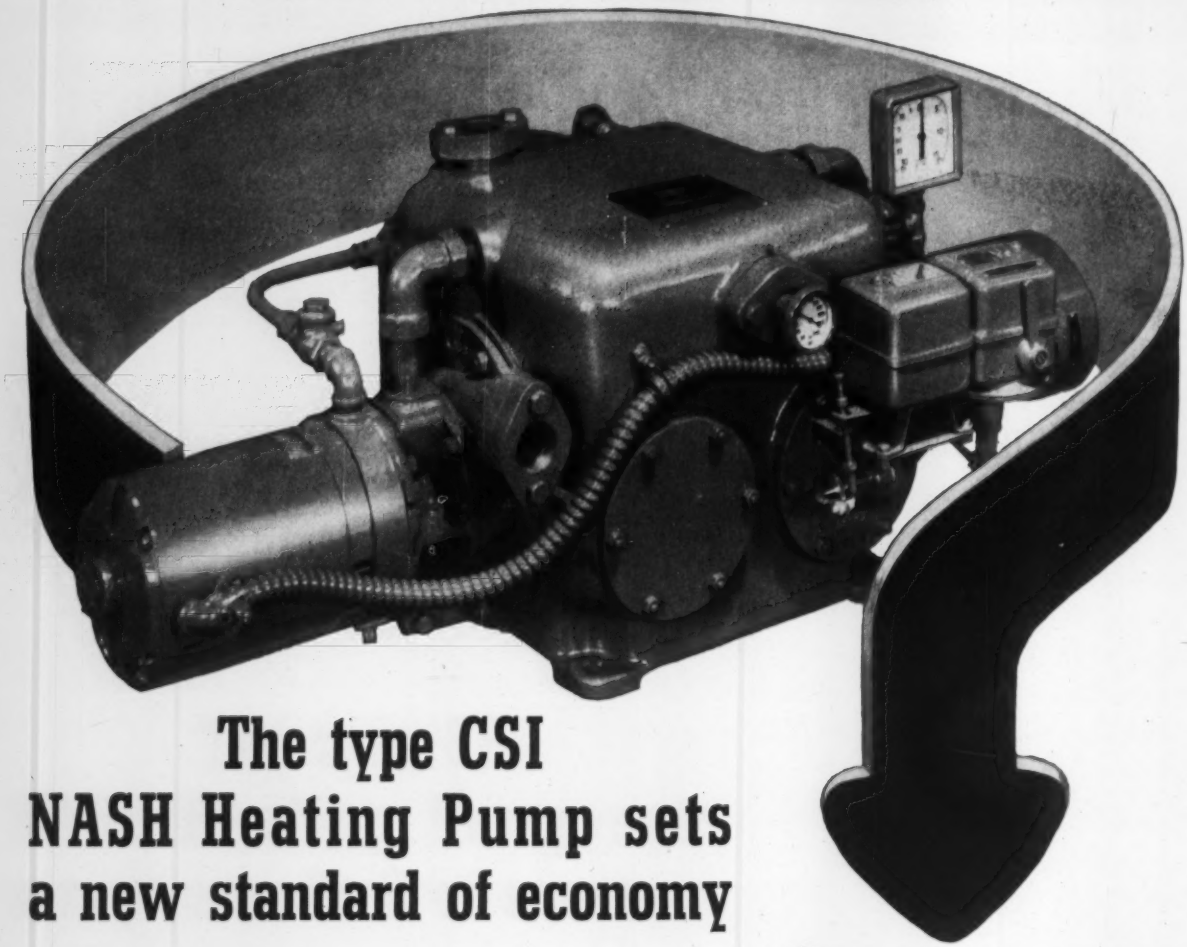

The type CSI NASH Heating Pump sets a new standard of economy

Now a Nash quality Vacuum Heating Pump can be economically installed and operated on any steam heating job. Engineered for high performance and low installed first cost, this new pump still makes use of time tested Nash principles of operation.

The Nash CSI has generous air capacity and features a wide choice of water capacities and discharge pressures. The right combination of capacities is at hand to match the requirements of the job. It is no longer necessary to pay extra for a pump with excessive water capacity, excessive discharge pressure, or in an attempt to get adequate air capacity.

With this advanced design, Architects, Engineers and Contractors will find answers to many heating system problems. Send for bulletin now.

1 ECONOMY IN FIRST COST

2 ECONOMY OF INSTALLATION

3 ECONOMY OF OPERATION

4 ECONOMY OF MAINTENANCE

NASH ENGINEERING COMPANY
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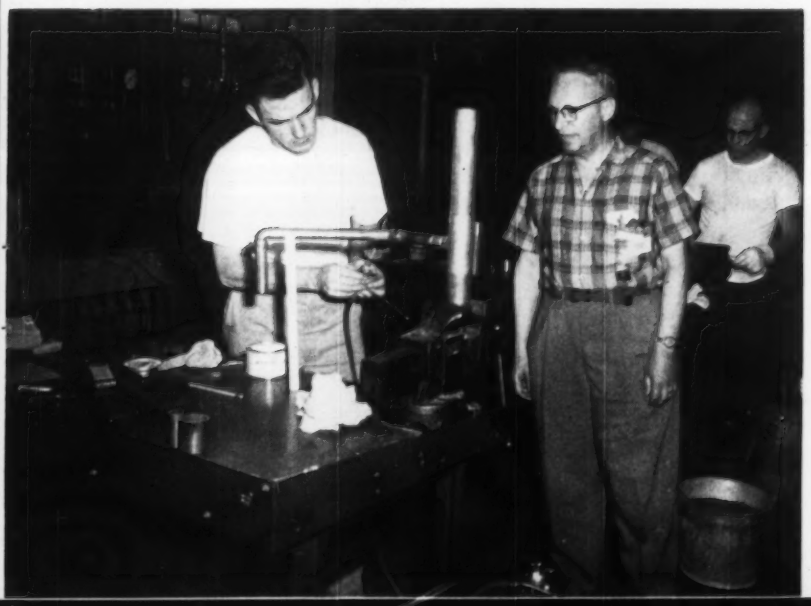
LEON C. HOELSCHER, Chicago, receives congratulatory handshake and $1000 first place cash prize from Peter T. Schoemann, UA general president. John J. McCartin, assistant general president of UA, looks on. Donald Sawyer, Detroit, and Edward P. Geib, Milwaukee, were second and third place winners, respectively. UA awarded plaques to winners' locals

Competition + Instructor Training = Skilled Pipe Fitters

. . . *for HPAC industry*

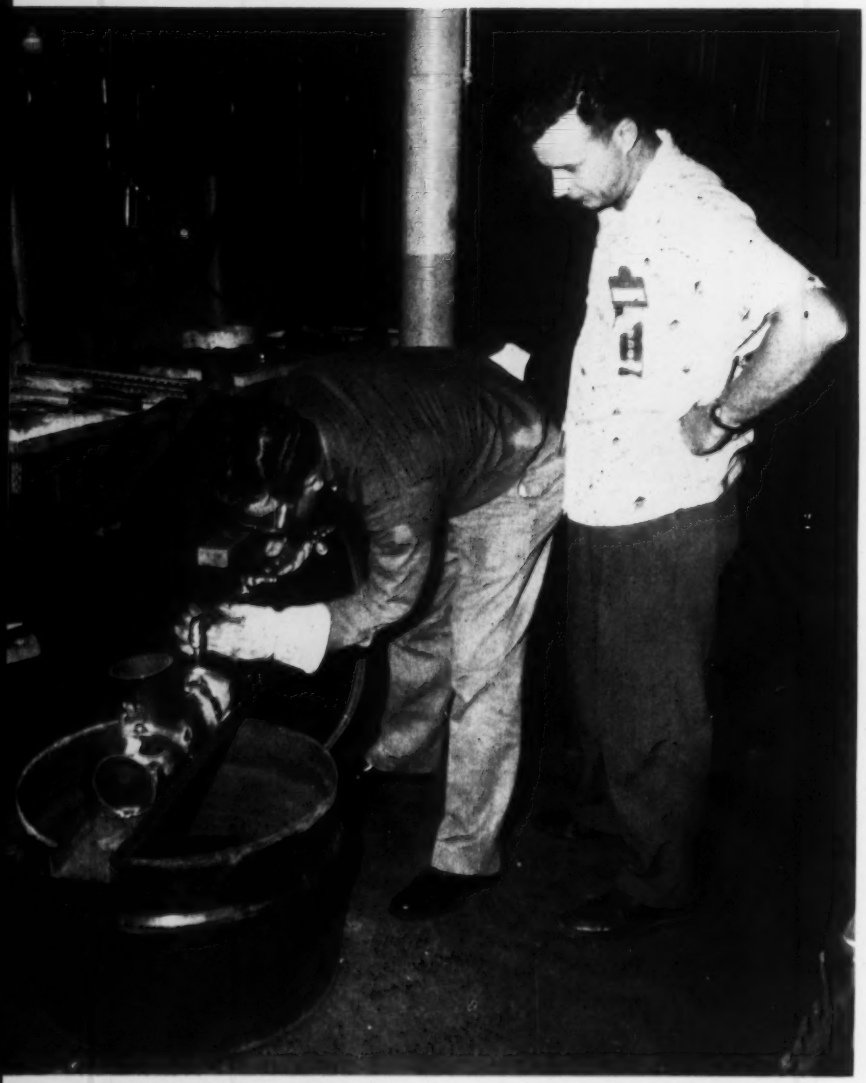
JUDGE ARTHUR HEIM observes apprentice performing brazing operation as part of pipe fitting contest. One-half of contestants' grades was based on performance tests; other half on written examination



THE FIFTH ANNUAL pipe fitter apprentice contest, sponsored by the United Association of Journeymen and Apprentices of the Plumbing and Pipe Fitting Industry and held at Purdue University from August 11 through 15, was won by Leon C. Hoelscher, Chicago. His score of 1760 brought him the first place cash award of $1000. Second place winner was Donald Sawyer, Detroit, who received $500 for his 1753 score. Edward P. Geib, Milwaukee, won third place with 1670 points and received $250.

Plaques were awarded to winners' local unions by the UA.

Fifth annual UA session at Purdue was highlighted by eager apprentice pipe fitters displaying their skills for top honors and cash awards. New teaching techniques—using demonstration models and closed circuit TV—were learned by 280 apprentice instructors. Cooperative efforts of the UA and MCAA are paying off in more and better skilled welders for the heating, piping, and air conditioning industry



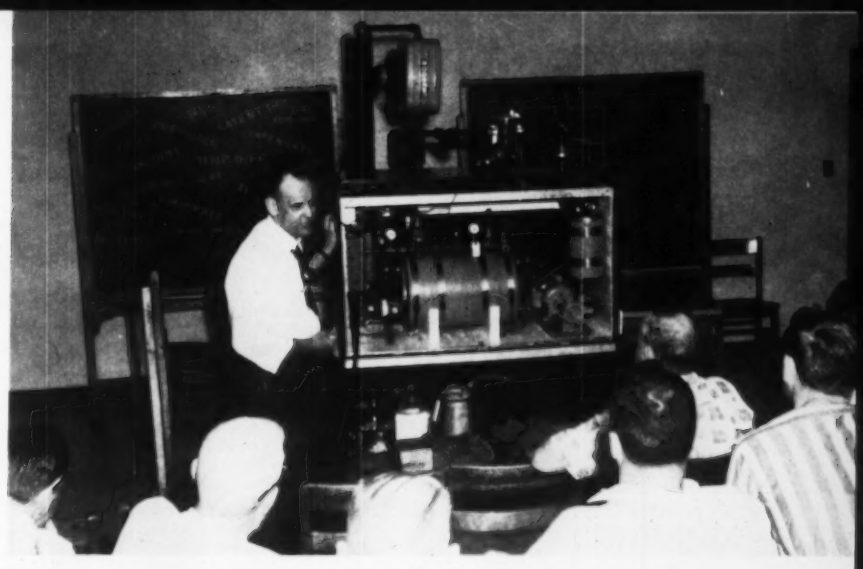
PIPE FITTER APPRENTICE competes in oxyacetylene welding test, while Judge William F. Green eyes his work. Other tests involved assembly of valves, traps, controls

First held in 1954, the annual contest at Purdue has fast become a national event in the heating, piping, and air conditioning industry. Peter T. Schoemann, UA general president, is devoted to the objective of improving the skills and knowledge of the apprentices through better teaching methods and facilities at all the local unions.

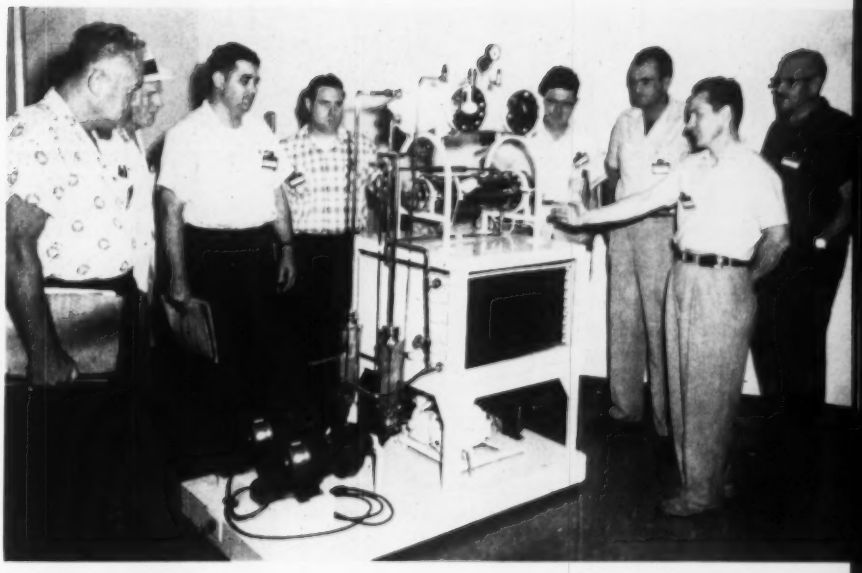
The apprentice training program consists of five years of study and training by each pipe fitter apprentice. This is climaxed by state contests, the winners being sent to Purdue for the national contest each August. The program is sponsored by the UA on the national level and by the local unions on state and local levels.

The Mechanical Contractors Association of America has a very important part in this program. The National Joint Pipe Fitting Apprentice Committee, made up of representatives from the UA and MCAA, coordinates the efforts of both groups for their mutual benefit. Thus, through the cooperative planning of management and its working force, the skills of the pipe fitter are being upgraded to meet the ever increasing demands of the heating, piping, and air conditioning industry.

Likewise, cooperation of manufacturers in the industry plays a major role. Their contributions of equipment for use at the local levels and for the state and national con-



HOW TO TEACH steam trap operation is demonstrated through use of portable boiler and glass steam trap by J. Fenner. Discussion of fundamentals preceded demonstration



ILLUSTRATING how refrigeration cycle can be divided into five parts for more effective teaching, William G. Carlisle uses demonstration model with glass view panels which permit observation of changing phases of refrigerant

CLOSED CIRCUIT TV was used to increase teaching effectiveness of how to weld small diameter pipe. Here, H. A. Sosnin shows welding operation. Use of several television receivers permits smaller groups, lets everyone see

TEACHING SOLUTIONS to refrigerant control problems was presented by R. N. Meyer through series of trouble shooting procedures. Shown on magnetic board is one condition where low suction pressure and high superheat were the conditions for which causes had to be found

tests have been invaluable in conducting this program.

Teach Instructors to Teach

Concurrent with this contest each year is an apprentice instructor training course in which apprentice instructors from practically every state and many Canadian provinces attend classroom sessions and learn how to teach the apprentices more effectively.

This year 280 apprentice instructors attended these sessions. Emphasis was placed on teaching techniques for various specific subjects. Those attending agree that this year's course was even better than it has ever been.

Among the subjects discussed in these sessions were the teaching of inert gas shielded arc welding, steam trap operation, principles of pneumatic controls, safety controls for heating and cooling systems, steam and refrigeration cycles, and solving problems in refrigerant control.

Instructors from industry conducted the sessions, while staff members from the Purdue Industrial Education Dept. taught such subjects as how to use visual aids, how to test and record apprentice progress, how to teach basic science, how to teach related mathematics, and how to use the discussion method.

Stress Pipe Welding Training

The critical need for qualified pipe welders was stressed in the elementary pipe welding and inert gas shielded arc pipe welding sessions. It was stated that the degree of instruction in welding needs to be increased because, at the present time, only 15 percent of the journeymen pipe fitters are qualified welders. With the new demands from nuclear power piping applications and advanced process piping systems, the need for qualified pipe welders is quite apparent.

TV Affords Close-up View

The classes on elementary welding, conducted by H. A. Sosnin and R. A. Fogarty, Tube Turns, Div. of Chemetron Corp., used closed circuit television to permit those attending to have a close-up view of the welds being made. The advantages of welding pipe were presented, and the trend toward increased use of light walled pipe was forecast when pipe is joined in this manner. Small sizes of pipe were also welded to demonstrate the ease with which this could be done.

Demonstrate Steam Trap Action

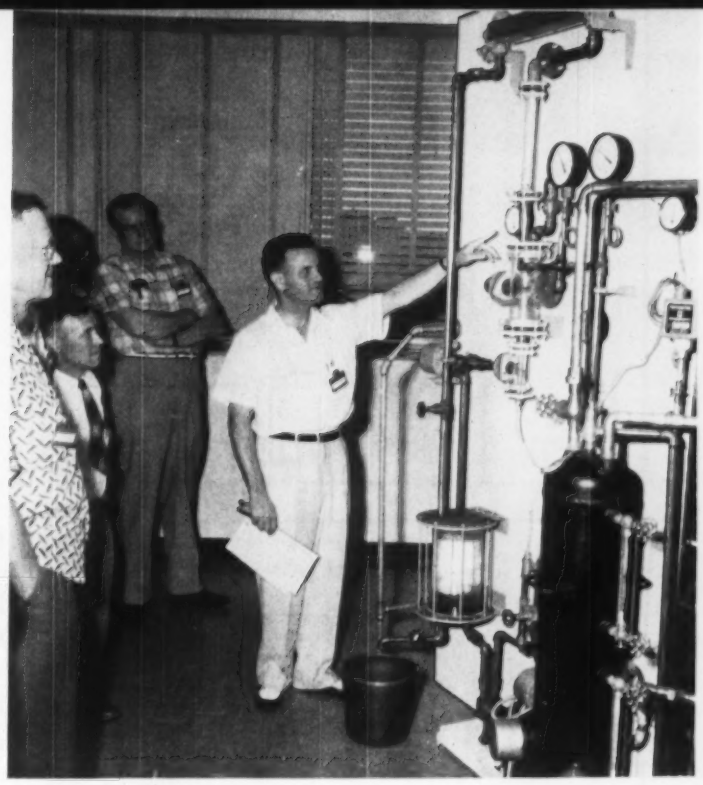
The analogy of steam trap operation with that of an expansion valve in the refrigeration system was made in the discussion presented by J. Fenner, Warren Barr Supply Co., on teaching steam trap operation.

Mr. Fenner introduced the basic principles necessary in understanding temperature, pressure, and sensible and latent heat. He then discussed the basic types of traps, their constructions, functions, how to select and trouble shoot, how to repair them.

A portable model boiler and steam piping system was used in demonstrating the action of the steam trap for various conditions. The trap was made of glass so this action could be observed. In this way the demonstration of the trap action was used to emphasize the principles presented verbally and by illustration.

Teach Refrigeration Cycle

The fundamentals of the refrigeration cycle were described by William



REFRIGERATION CYCLE was compared with steam cycle through use of this glass pipe demonstration model which can illustrate more than 50 different conditions by adjusting one or more valves. Dwight E. Shytle served as instructor

G. Carlisle and Robert T. DeWyze, Bell & Gossett Co., in five parts:

1) The space cooling unit which removes heat and moisture from the air.

2) The evaporator where the refrigerant removes heat from the water circulated to the room unit. A metering device, usually an expansion valve, is used to control the flow of refrigerant to the evaporator.

3) The compressor which draws in the vaporized refrigerant and raises its pressure and temperature.

4) The condenser which receives the vapor for cooling when it is changed back to a liquid and is returned to the evaporator.

5) The cooling tower which is used to cool the water that cools the refrigerant in the condenser.

This information was presented in three different ways to illustrate how the subject can be taught effectively. First, the information was presented by slides, along with a discussion of each point. Next, the same information was presented more informally with a portable blackboard used to illustrate the points. The third method consisted of a demonstration and the use of a model in which the various parts could be observed.

The refrigeration cycle was also discussed by Dwight E. Shytle, Combustioneer Corp., mechanical (heating, piping, and air conditioning) contractors. In this session the pressure and temperature relationships of refrigerants were presented. The need for basic knowledge of the refrigeration cycle and how the various refrigerants react under different conditions were emphasized. Frequent analogies were made with the steam cycle. To illustrate what happens, a glass boiler and glass piping system, designed by Joseph P. Corcoran, was used to show several conditions that occur by adjusting one or more valves.

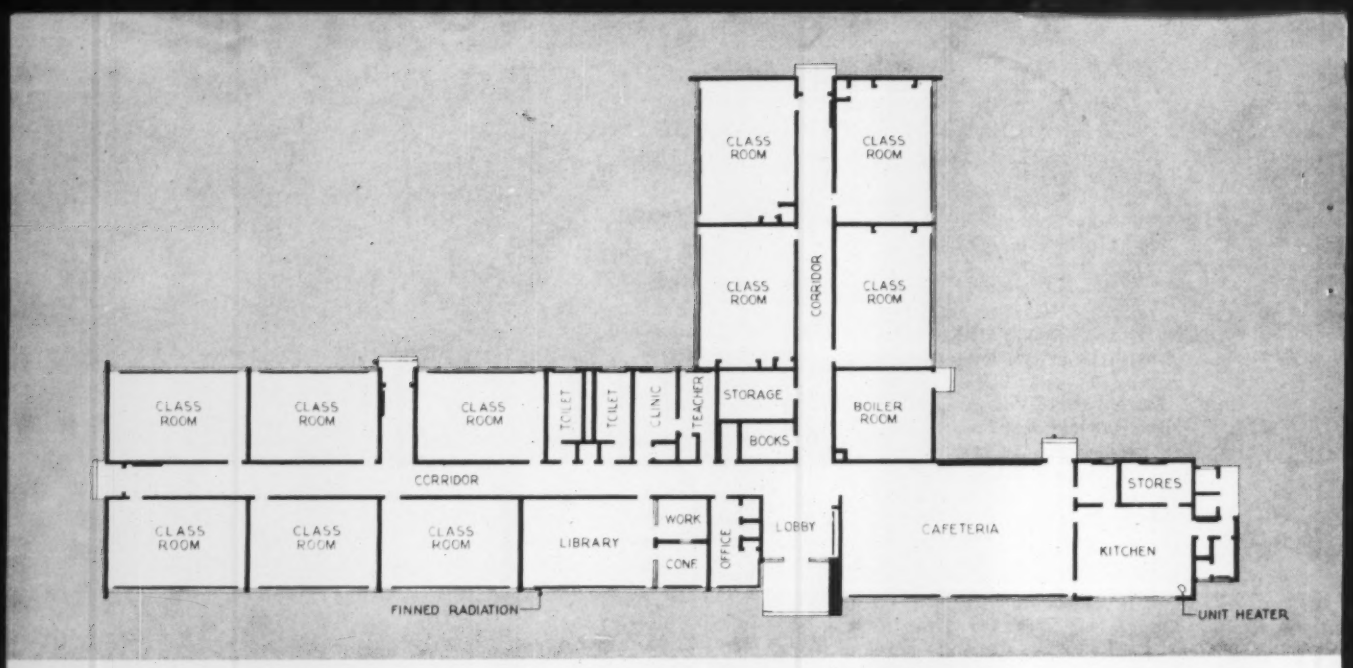
Study Refrigerant Control

In instructing how to teach refrigerant control, R. N. Meyer, Alco Valve Co., went into an exhaustive study of the thermostatic expansion valve — including what it does and where the bulb should be located in order to achieve dependable service from refrigeration and air conditioning equipment.

Mr. Meyer then turned to several trouble shooting problems. He suggested that, in any problem of this sort, the compressor discharge and suction pressures should be recorded along with the superheat temperature at the evaporator outlet. The suction pressure should be determined with an accurate gage at the evaporator outlet, he said.

On close coupled installations the suction pressure may be recorded at the compressor suction connection. Then, from refrigerant pressure-temperature tables, the saturation temperature at the observed suction pressure can be determined. Next, the temperature of the suction gas is measured at the expansion valve remote bulb location. The best method for measuring this temperature is to clean an area of the suction line and tape a thermocouple to the cleaned surface, Mr. Meyer stated. The thermocouple should be insulated and the temperature read by means of a potentiometer. The saturation temperature (read from the tables) is subtracted from the temperature measured by the thermocouple and the difference is the superheat of the suction gas.

The sixth annual UA apprentice contest and concurrent instructors training course will be conducted next August, again at Purdue. ±



USE ELECTRICITY OR OIL TO HEAT THIS SCHOOL?

. . . Here Are *Actual* Cost Comparisons

Electrical systems cost less to install and more to operate. But how much less and how much more can only be determined through careful evaluation of the design problem for each particular school. Besides weighing installation and operating costs, consideration must be given to maintenance and life expectancy of equipment.

BY DENARD L. GUSLER
Professional Engineer
Clark, Buhr & Nexsen
Architects—Engineers

CONSULTING ENGINEERING offices are finding it more and more necessary to give serious consideration to the possible use of electric resistance heating in schools they design. This necessity has been generated not only by the desire of engineering staffs to use the most efficient equipment and modern methods available, but also by the effort of the public utility companies in some localities to promote this type of heating as being less expensive than conventional systems — both in costs of installation and annual costs of operation.

The initial cost advantages generally claimed for the all-electric school are:

1) Elimination of hot water or steam boilers, with their associated controls, fuel pumps, circulating pumps, fuel preheaters, ignition systems, etc. (*This claim is entirely correct. The utility will generally furnish transformers at no cost to the owner. These transformers are located exterior to the building, usually on poles.*)

2) Elimination of a boiler room, which reduces the size of the building or sometimes adds welcome space to the educational facilities. (*This claim is essentially correct; however, it is occasionally necessary to use part of the boiler room area as a utility room for incoming main electric panels, hot water heaters, etc.*)

3) Elimination of a smoke stack, which is not only a costly item but spoils the beauty of design that the school people and the architects try so hard to achieve. (*This claim is correct; however, the smoke stack can be reduced in size by utilizing mechanical draft.*)

4) Elimination of fuel storage facilities not only saves space and expense but removes dirt, fire hazard, and any items associated with fuel delivery. (*This claim is correct to a limited extent, depending on the housekeeping of the school affected.*)

5) Elimination of expensive controls. These can be replaced with simple, low maintenance, and low cost thermostats that function within a tolerance of about ±1 F deg. (*This is debatable, as will be discussed.*)

The foregoing factors have resulted in savings of over 10 percent of total building costs, as claimed in some instances by the advocates of electric resistance heating.

It is not the intent of this article to evaluate the validity of these claims. An attempt *will* be made, however, to evaluate the utilization of electric resistance heating for a particular school in Virginia designed by our firm.

During recent years, we have prepared contract plans and specifications for a number of standard 10-classroom schools. Each of these is equipped with a multi-purpose room or cafeteria, kitchen, offices, and utility spaces, as shown in Fig. 1. These units usually cost $10.00 to $11.00 per sq ft and comprise 16,000 to 20,000 sq ft in total area.

Obviously, for construction costs to be limited to this low value, it is absolutely essential that heating, ventilating, plumbing, and electrical systems be simple in design and that they require economic selection of materials of construction. Despite simplicity in design, it is necessary that all systems meet the exacting standards of the state boards of education.

A typical construction outline for the mechanical and electrical systems is as follows:

Heating and ventilating: Two-pipe steam, steel supply piping, copper return piping, glass fiber insulation, finned radiation, exhaust ventilation with ductwork and related grilles connected to power roof ventilators, automatic oil fired boiler, and limited automatic zone control. Installation must be made in accordance with accepted standards.

Electrical: Incandescent fixtures, conduit, and wiring, in accordance with National Electrical Code requirements.

The construction costs for a school as described were as follows:

Total building cost (Building contained 16,550 sq ft at $10.20 per sq ft)	$169,400
Heating and ventilating subcontract ($0.85 per sq ft, or 8.35 percent of total building cost)	$ 14,129
Electrical subcontract ($0.68 per sq ft, or 6.63 percent of total building cost)	$ 11,280

The foregoing cost data clearly indicates that the mechanical and electrical systems have been reduced to the a minimum. Generally, either coal and fuel oil is used to heat these schools and mechanical exhaust ventilation is provided. A typical tabulation of heat losses and ventilation requirements is given in Table 1.

The following factors merit careful analysis:

- Initial cost of installation
- Seasonal cost of operation
- Annual cost of maintenance
- Expected life.

Installation Cost Favors Electricity

To determine the initial cost is most difficult unless a selected school is designed for heating with oil and a separate set of plans prepared for heating electrically. To make an evaluation for this article, a set of plans was given to a local utility and a reputable manufacturer of the electrical equipment. This was done with the full realization that each would limit his costs to the minimum possible.

At the same time, the costs of other schools were obtained and it was found that the lowest cost for electric resistance heating on a square foot basis was $1.16 and the highest cost was $1.53. Using the lower figure, 16,550 sq ft × $1.16 = $19,200 for electric resistance heating of the school under consideration.

This value cannot be accurately compared to the figure quoted for using fuel oil because a minimum of automatic controls was provided. To provide automatic controls comparable to control furnished with the electric resistance heating would cost $3700.

The difference between initial costs will then be:

Electric resistance heating system		$19,200	
Heating with fuel oil	$14,129		
Automatic controls	3,700		
		17,829	
Difference (in favor of fuel oil)			$1371
Boiler room — 21 × 22 ft = 462 sq ft; 462 sq ft × $10.20 =		$4700	
Utility room — (required for distribution panels, hot water heaters, etc., when electric resistance is used) 10 × 12 ft = 120 sq ft; 120 sq ft × $10.20 =		1220	
Difference (in favor of electric resistance heating)			3480
Net Difference (in favor of electric resistance heating)			$2109

The foregoing analysis would indicate that a saving of about 10 percent in initial cost is possible when electric resistance heating is used. This initial saving can undoubtedly be increased when a more complex type of mechanical heating system is considered.

But Operating Costs Favor Fuel Oil

Any comparison of annual operating costs is considerably more involved. By using the time honored degree day method, the following results are evolved:

Heating with fuel oil
Annual heat loss in Btu = 24 × 4153 degree days × 1,185,900 Btu/(70 F − 5 F) = 1810 million Btu
Annual fuel oil required in gallons = 1810 million Btu/70 percent efficiency × 145,000 Btu per gal = 17,900 gal
17,900 gal × 16c per gal = $2860 for No. 2 domestic fuel oil
17,900 gal × 10c per gal = $1790 for No. 5 commercial fuel oil
Electric resistance heating
Annual kilowatt hours = 1810 million Btu/100 percent × 3415 = 530,000 kwhr
530,000 kwhr × 1.5c = $7960

The obvious difference is $5100 in favor of No. 2 fuel oil and $6170 in favor of No. 5 fuel oil. Since this is a seasonal saving, the accumulated saving that will accrue over a period of years is obvious, particularly since a well designed steam heating system will have a life expectancy of about 30 years.

Degree Days Don't Tell Whole Story

However, the degree day method does not present a realistic picture for a completely automatic, properly operated electrical or mechanical heating system. To take full advantage of the automatic system possible with electric resistance heating, and the heat gain from students and electric lighting, we should use the following method of calculation:

Electric resistance heating

Number of school days per year = 170
School hours per day (ventilation) = 7

1) Ventilating hours per season = 1190
Occupied temperature hours per day = 9

2) Occupied temperature hours (without ventilation) = 2 × 170 = 340

Total hours
1190
340
1530 hours

3) Non-occupied hours
37 weeks
7 days
24 hr per day
6216 total hr in school session
− 1530
4686 hr

Winter design temperature = +5 F
Average winter temperature = 46 F
Temperature difference, occupied = 70 F − 46 F = 24 F
Temperature non-occupied = 55 F − 46 F = 9 F
Heat loss of building 602,579 Btu per hr.
Ventilation air loss 581,236 Btu per hr.
1,183,815

1) Hours of occupancy with ventilation, 70 F
Btu per F deg = 1,183,815/65 = 18,214
kwhr = (18,214 × 24 F × 1190 hr)/3413 = 152,415 kwhr
2) Hours of occupancy *without* ventilation, 70 F
Btu per F deg = 602,579/65 = 9280
kwhr = (9280 × 24 F × 340 hr)/3413 = 22,200 kwhr
3) Non-occupied hours (no ventilation), 55 F
Btu per F deg = 602,579/50 = 12,050
kwhr = (12,050 × 9 F × 4686 hr)/3413 = 148,900 kwhr

Totals
152,415 kwhr
22,200
148,900
323,515 kwhr at 1.5c = $4840

Credits:
Lights: 60 kw connected; Use 50 kw
50 kw × 1530 hr = 76,500 kwhr
Usage factor of 75 percent = 57,375 kwhr
People: (10 classrooms at 30 students per room × 300 Btu per student)/3413
= 90,000/3413 = 26 kw
= 26 kw × 1190 hr = 30,940 kwhr
Total = 57,375
30,940
88,315 kwhr at 1.5c = $1325
Net operating cost = $4840
1325
$3515

Heating with fuel oil

Hours of occupancy with ventilation, 70 F
Btu per F deg = 1,183,815/65 = 18,214
Gallons = (18,214 × 24 F × 1190 hr)/(70 percent efficiency × 145,000 Btu per gal) = 5130 gal

Hours of occupancy *without* ventilation, 70 F
Btu per F deg = 602,579/65 = 9102
Gallons = (9102 × 24 F × 340 hr)/(70 percent × 145,000) = 732 gal

Non-occupied hours (no ventilation), 55 F
Btu per F deg = 602,579/50 = 12,050
Gallons = (12,050 × 9 F × 4686)/(70 percent × 145,000) = 5020 gal

Total 10,882 gal

Credits: (See electrical calculations)
Lights: 57,375 kwhr
People: 30,940 kwhr
Total: 88,315 kwhr
Gallons = (88,315 kwhr × 3415 Btu per kwhr)/(70 percent × 145,000) = 2970 gal

Net Total 7912 gal

7912 gal × 16c = $1265 for No. 2 fuel oil.
7912 gal × 10c = $ 791 for No. 5 fuel oil.

The difference in $2250 in favor of No. 2 fuel oil and $2724 in favor of commercial No. 5 fuel oil.

From the foregoing, it is evident that electric resistance heating, when calulated on a degree day basis, will cost 2.7 times more than domestic No. 2 fuel oil for seasonal fuel cost for this particular school. In like manner, when calculated on an actual utilization basis with fuel automatic controls and taking credit for lights and people, electric resistance heating will cost approximately the same ratio over heating with fuel oil. The data given indicates that a saving of about 65 percent in annual fuel costs is possible when heating with fuel oil.

It's Hard to Evaluate Maintenance Costs

The annual cost of maintenance for either the mechanical or electrical system is almost impossible to evaluate because of many variable factors. An oil fired steam heating system will obviously require more maintenance in the boiler room. At the same time, it will generally require very little maintenance in the building. The janitorial service will be performed by a male janitor on a yearly basis and his salary will generally be the same regardless of the method of heating the building.

Maintenance of an electrical system—with its contactors, resistance elements, etc.—will probably be performed under a service contract by an electrical maintenance contractor. In any event, the difference between mechanical and electrical systems should not be appreciable.

Life Expectancy Favors Fuel Oil

The fourth and last factor, expected life, is also most difficult to evaluate. A properly designed steam or hot water heating system will last 30 years if well maintained. An electrical system might be expected to last also for a substantial period of time, except for replacement of the heating elements. A check with one manufacturer indi-

TABLE 1—TYPICAL TABULATION of a school's heat losses and ventilation requirements is given below

Room	Heat loss, Btu per hr	Ventilation requirements, cfm	Ventilating-heating load, Btu per hr	Total heating load, Btu per hr
Classroom	44,890	310	21,100	65,990
Classroom	44,890	310	21,100	65,990
Classroom	38,550	300	21,100	59,650
Classroom	38,550	300	21,100	59,650
Classroom	39,030	330	23,200	62,230
Classroom	33,680	330	23,200	56,880
Classroom	33,680	330	23,200	56,880
Classroom	39,030	330	23,200	62,230
Classroom	33,680	330	23,200	56,880
Classroom	33,680	330	23,200	56,880
Library	42,120	385	27,000	69,120
Conference Room	10,084	250	17,060	27,144
Principal's Office	16,204	110	7,720	23,924
Teachers' Lounge	4,553	96	6,740	11,293
Clinic	7,214	115	8,070	15,284
Boys' Toilet	5,612	210	13,850	19,462
Girls' Toilet	5,910	120	7,900	13,810
Cafeteria	75,620	1,500	102,060	178,680
Kitchen	29,605	1,400	87,696	116,701
Dishwashing	5,882	15 (fan)	(940)	5,882
Dry Stores	10,715	115	7,200	17,915
Help's Toilet	9,890	—	—	9,890
Lobby	—	630	42,800	42,850
Corridors	—	420 (each entrance)	28,600	28,600
			581,236	1,183,815

cated that 10 years would be the life expectancy of most heating elements. Periodic and progressive replacement of heating elements will be expensive. But it is also expensive to replace the tubes in a boiler, or to reline a furnace.

Each School Is a Separate Problem

This article has frankly presented a strong case for mechanical heating systems utilizing fuel oil for heating at current rates. These rates will, of course, vary, depending on the availability of fuel oil. Electrical rates will likewise vary. The present rate in rural communities where the described elementary school was constructed is 1.5c per kwhr. Rates may be as low as 1c per kwhr in some areas. The 1.5c rate is generally a flat rate with no demand change.

Regardless of the argument presented, it is not intended to infer that mechanical systems will always be cheaper or more desirable than the electrical systems. Each school proposed for construction is a separate problem which must be carefully evaluated for the most economic and desirable solution as to what system to use.

Engineer Must Sell Services, *Not* Products

This evaluation can best be undertaken by the engineer that sells only services and not a product. One electrical utility specializing in the manufacture, distribution, and sale of electrical power has actually set up an engineering staff and offers services to architects for the design of electric resistance heating systems. These services are free for the asking. This sort of "engineering salesmanship" may eventually cause the oil companies and gas utilities to organize similar engineering departments.

Impartial engineering analysis is the prerogative of the consulting engineer. Let's keep it that way. ⧺

SAM LEWIS SAYS...

"Sometimes We Design for *Dis*comfort

. . . a steam room, for example"

I REMEMBER mentioning a "sauna" in some yarn written years ago. This was a well insulated, shedlike accessory to a home (especially incidental to Scandinavian countries) in which water from a dipper was dashed upon hot coals or embers to develop a very warm, very humid atmosphere.

The steam filled the enclosure and gave the occupant a sensation much like slapping himself with a bundle of wet-dipped twigs. He ultimately emerged *clean*, his high rate of perspiration having been effective in elimination of undesirable wastes.

A modern steam room — frequently the adjunct of a gymnasium — has nozzles for admitting low pressure steam from the boiler of the heating system. It is, in essence, designed for *dis*comfort. The structure may have a floor area of perhaps 60 to 100 sq ft, with the ceiling usually only high enough to avoid bumping the heads of tall athletes. The bather sits on a warm slab and visits with other participants in the ritual until the heat becomes so intense as to drive him out.

The rate of steam injection to the room may be in charge of an attendant, though the bather himself may open or close the valve. Trapped floor drains for the constantly accumulating condensate and moisture are imperative. In a modern public bath establishment, supervision by an attendant — not necessarily within the steam room — is wise, since a bather could faint or fall, due to the natural attempt by his body to counteract the heat.

Continuous introduction of new air and removal of odorous air for the steam room proper is not usually provided for, since this would militate against the desired temperature and moisture condition in the room. It is practicable and desirable to provide air supply and exhaust openings connected with the ventilating system of the baths, or with that for the gymnasium, whereby the steam room air may be changed by closing the steam supply and by opening inlet and outlet air ducts for the room.

It is practicable to provide a thermostat in the steam room which will actuate the steam supply valve to open or to close in response to temperature. The openings for steam injection should be so located as to assist in diffusing the steam, and so as not to injure a bather, either by direct blast or by dripping.

One acceptable method for protecting bathers is for the steam to enter through a nozzle behind a deflecting platterlike baffle in a side wall so that condensate cannot drip on them.

Safeguards, of course, should be provided so that the steam supply cannot be at a pressure appreciably higher than that of the atmosphere. A pressure relief vent from the steam room — preferably at floor level — is desirable. Its minimum size per bather should be about 3 sq in. ⧺

SAMUEL R. LEWIS, *consulting mechanical engineer and a member of Heating, Piping & Air Conditioning's board of consulting and contributing editors, comments informally each month on practical problems in the field.*

How An Office Building's Occupancy

. . . three new Manhattan skyscrapers show how a building's purpose

BY LEWIS SMITH
Heating Engineer

TYPICAL of new large office building construction is Time & Life Bldg. which will rise 48 stories above midtown New York, as shown in architects model. Time, Inc.'s magazine deadlines requiring unusual working hours placed special requirements on air conditioning design

THREE office buildings presently under construction in New York City represent three distinctly different approaches to air conditioning. Why? Because each building, while not vastly dissimilar from the other two, is being erected to serve a different purpose.

The Union Carbide Bldg. is designed primarily to house the offices of Union Carbide Corp. Only a minor portion of the structure will be rented to others. The company is erecting and will own and operate the building. Obviously, its needs come first.

The Time & Life Bldg., on the other hand, is to be a cross between an owner occupied building and a strictly commercial one. Time, Inc. and its affiliates will occupy 20 floors. About 90 percent of the remaining space has been rented.

No. 2 Broadway is a strictly commercial structure. It will have to compete with other buildings of its kind in of income. The building must be flexible in design so lower Manhattan — with its rentals providing its source that the air conditioning installation can be adapted to the different needs of various tenants.

Therefore it is very often the type of occupancy for which a building is planned that influences the design of its air conditioning system. Conspicuous among these influences for the aforementioned three are:

1) The exceptional use of glass and the modular design of the Union Carbide Bldg. to facilitate the use of the space as the company's home office.

2) The requirement for abnormal working hours in the space to be occupied by Time, Inc. in the Time & Life Bldg.

3) The necessity for minimizing the installation and operating costs at No. 2 Broadway — at the same time giving service compatible with the rental market.

• Union Carbide's system conforms to modular layout

BOUNDED by Madison and Park Aves. and 47th and 48th Sts., the Union Carbide Bldg. will have a gross floor area of 1.5 million sq ft and a net area of 1,150,000 sq ft. It will have 12 stories on Madison Ave. and 50 on Park Ave., plus two equipment floors.

Total refrigeration capacity of the system is to be 5000 tons, with two 1000 ton units on the 51st floor and three 1000 ton units in a sub-basement on the Madison Ave. side. All five are centrifugals, with steam turbine drive.

Perimeter heating and cooling is to be by a high velocity conduit system with induction units. The interior system will have fan rooms on the 12th to 13th floors, 34th to 35th floors, and the roof.

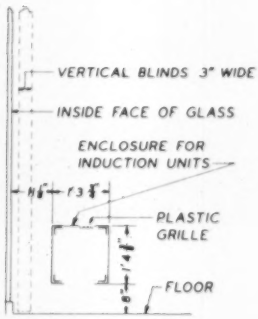
Vertical supply ducts are to be of the dual type, with single ducts furred into the ceiling on each floor,

Affects Its Air Conditioning Design

often outweighs its structure in choosing a system layout

zoned for exposure, occupancy, and convenience. Thermostatic control for each zone will be from the return air temperature.

The entire structure is designed on 5 ft modules. The exterior wall being principally glass extending to the floor, the induction units will be mounted on 5 ft centers within a continuous sheet metal enclosure in an angle iron frame extending from column to column, as shown in Fig. 1, with floor supports in the middle of each bay which will also serve as air and piping connections.



1 BUILT on 5 ft modules, Union Carbide Bldg. will have induction units mounted on 5 ft centers within continuous sheet metal enclosure in angle iron frame extending from column to column with floor supports in middle of each bay

Columns are mainly on 20 ft centers, with some more than that and a few as far apart as 45 ft. Hence, four air conditioning units will be installed in most bays, while in a few cases nine units will be supported in this manner.

To avoid furring out the walls or columns, there are no risers to the exterior walls. Instead, all air ducts and water pipes are to be located in interior shafts with lateral distribution lines in the hung ceilings.

In the 20 ft bays, ducts and piping will be brought through the floor at the center of the bay to supply two induction units on each side. In the wider bays a similar plan will be followed, with sufficient floor supports so that each one supplies three to four units at a time.

Each pair of induction units will be controlled by a room thermostat operating a water valve on each unit. Thus, offices can be partitioned in 10 ft modules and there will be at least two units enclosed in each space. One of these units will be controlled from the thermostat in that space.

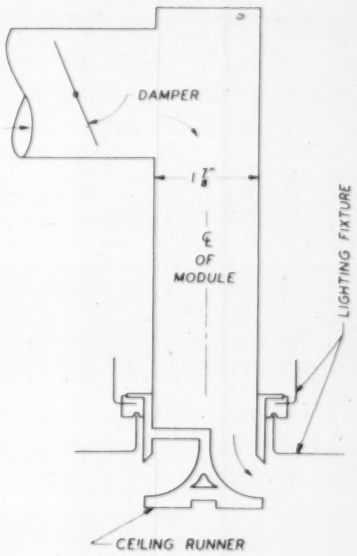
An ingenious and possibly unique method of air distribution from the ceiling ducts was devised by the consulting engineers to fit into this modular design. This is shown in elevation in Fig. 2. The ceilings consist of lighting fixtures in an overall pattern spaced by ceiling runners on 5 ft centers in each direction. The runners shown are on 10 ft centers and serve the purpose of spacing the fixtures and supplying (or returning) the air.

These runners have slotted openings 18 to 24 in. long to handle from 25 to 120 cfm. They can be installed so that the openings face either way. Openings are separated by blank sections as required. A damper is located in the circular supply duct connection for balancing purposes. Return air is similarly handled.

The engineers have calculated that — with the large solar heat gain through the glass walls, plus the heat gain from other sources — cooling will be required most of the year, with little need for heat until the outside temperature approaches 20 F.

Since there are few days in New York City when the temperature stays as low as that for more than a few hours, it was deemed expedient to use the summer cycle the year 'round. This eliminates heat exchangers for heating the water. Also, there will be no changeover period during spring and fall, thus simplifying system operation.

Room temperature control will be accomplished by heating the primary air to the induction units and relying



2 AIR DISTRIBUTION in Union Carbide Bldg. will be via ceiling ducts. Ceilings will consist of lighting fixtures in pattern spaced by runners on 5 ft centers each way

on the room thermostats to control the water to these units. The cooling tower will be arranged to operate through the winter.

The architects for the Union Carbide Bldg. are Skidmore, Owings, and Merrill. Syska and Hennessy, Inc. are the consulting engineers. The mechanical (heating, piping, and air conditioning) contractors are Kerby Saunders, Inc. and Raisler Corp.

(Continued on next page)

(Continued from preceding page)

• Time's work habits dictate system design

The Time & Life Bldg. will be situated on a plot 200 × 410 ft at 1271 Avenue of the Americas, between 50th and 51st Sts. The main structure will have 48 stories, with a seven-story "L" shaped building wrapped around the north and west sides. The gross floor area will be 2 million sq ft, the net rentable space being 1.5 million sq ft.

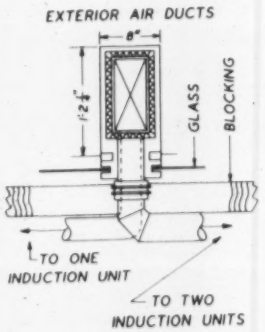
Total refrigeration capacity is to be 5950 tons, with one plant on the 47th floor housing one 850 ton and one 1700 ton compressor, and a second plant in the third sub-basement containing one 680 ton and two 1360 ton compressors. All compressors are centrifugal type, driven by steam turbines. The choice of one-third and two-thirds capacities was made in the interest of efficiency at times of low cooling load.

Perimeter heating and cooling is to be by a high velocity conduit system, with three induction units in each 28 ft bay in the tower building.

The architectural design calls for smooth interior walls, unbroken by columns or ducts. The structural columns are therefore being placed outside the walls. While there is space to fur in the water piping without interfering with the interior wall surface, this cannot be done with the air ducts or conduits.

To meet this requirement the consulting engineers came up with a design whereby the air ducts are external to the building, as shown in Fig. 3. These ducts will be finished not only to harmonize with the external appearance of the structure, but to accentuate the sheer vertical sweep of the facade.

These air ducts will, of course, be well insulated, being made up to prevent leakage and to take care of expansion.



3 AIR DUCTS will be external to structure in Time & Life Bldg., since architecture calls for smooth interior walls, unbroken by columns or ducts. Two ducts will serve each 28 ft bay. At each floor, two branch connections will supply three induction units in that bay

Two ducts serve each bay. At each floor one of these ducts will have two branch connections, as shown in Fig. 3, to supply the air to the three induction units in that bay. These connections are to be arranged to split the total air volume between them to achieve balanced flow.

The interior air conditioning will have four fan rooms. These are planned for the third sub-basement and the 10th, 35th, and 46th floors. From the second to the ninth floors, dual risers will be used, with distribution on each floor by single ducts. From the 10th floor up, single air risers will be used with reheaters for each zone on each floor for temperature control.

Time, Inc., which publishes a number of weekly and monthly magazines with various deadlines, will occupy 16 floors. This means that some floors will be occupied on all days of the week and for different working hours.

So as not to air condition all these floors all the time, the branches from the supply ducts on each floor will be equipped with shutoff dampers operated from a conveniently located control panel. Thus, the occupied floors can have full service at the same time the unoccupied ones are shut off.

Since this arrangement would increase the static pressure in ducts on the occupied floors, pressure controls are to be installed to position these dampers to maintain a constant air volume at the outlets.

Some of these floors will have such a large heat gain from electrical equipment that cooling will be required through most of the year. Hence, one cell of the cooling towers will be winterized for year 'round operation.

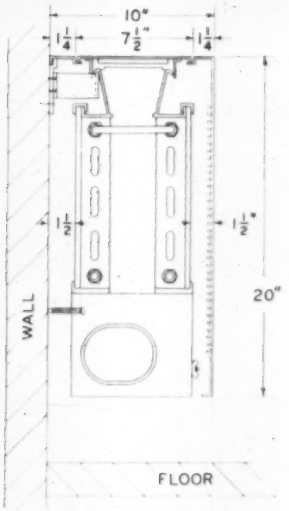
To be jointly owned by Rockefeller Center, Inc. and Time, Inc., the building has Harrison and Abramovitz and Harris as its architects. Syska and Hennessy, Inc. are the consulting engineers. Almirall Co. and Wolff & Munier, Inc. are the mechanical (heating, piping, and air conditioning) contractors.

• flexibility is a must for multi-tenanted 2 Broadway

No. 2 Broadway will have 30 stories, plus four stories mainly for equipment. It gross floor area will be 1,450,000 sq ft, with a net rentable area of 1.3 million sq ft.

The total cooling capacity of 4650 tons will be supplied by three 1550 ton steam turbine driven centrifugal compressors located on the roof.

Perimeter air conditioning, again, will be by a high velocity conduit system. Initially, two induction units are to be in each 20 ft bay. Most of these units have two coils, as shown in Fig. 4. Their capacity in Btu per hour per cubic foot per minute of primary air is said to be much greater than the capacity of the ordinary single coil unit. This may permit reducing the flow rate of primary air down to the ventilation re-



4 AT 2 BROADWAY initially two induction units will be located in each 20 ft. bay. Most of these units have two coils for increased capacity at reduced primary air flow rates. Units are to be wall mounted, free standing

quirement only, making a saving in the cost of ducts and fans.

Each unit will have a water flow control valve and each group of four units will be controlled from one room thermostat. The water piping is arranged for four zones per floor and two zones vertically. Each zone is to have a flow valve operated from an outdoor thermostat.

The interior system is designed for six zones per floor up to the 24th floor. Above this each floor will have two zones. Fan rooms will be located on the ninth, 24th, and top floors. This system, depending on tenants' needs, can be and has been supplemented by additional systems.

Distribution is to be by low velocity ducts designed not only to meet the needs of the particular tenant, but also for the special use of particular areas within the individual tenant's space. Air is distributed and returned via vertical ducts. Reheaters on each floor for each zone are controlled from the return air temperature. The vertical ducts will be sheet metal, inside masonry shafts which are to serve as return ducts.

As was stated, the use of two induction units is only for the initial installation. Changes will be made in location, size, number and control of the units, depending on the tenant usage.

The architects for No. 2 Broadway are Emery Roth & Sons. The consulting engineers are Henry B. Oehrig and Rutherford L. Stinard. The mechanical (heating, piping, and air conditioning) contractor is Raisler Corp. ‡

Fig. 4 courtesy York Corp.

Research Reveals Rust Rates in U.S. Cities

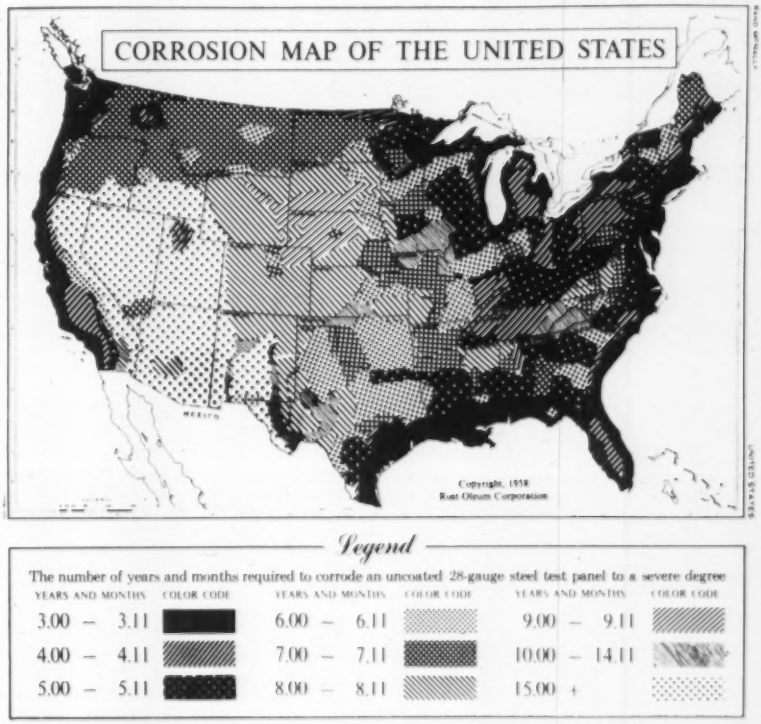
. . . highest in industrial centers

THE COMPARATIVE RATES at which rust proceeds in different parts of the U.S. have been established for all cities over 10,000 population.

It takes 3 years — the fastest rate in the country — for rust to corrode a standard uncoated steel test panel the size of an auto license plate in four different cities: Buffalo and Rochester, N. Y.; Erie, Pa.; and Miami, Fla. Slowest rust rate — more than 15 years — is in Tucson, Ariz., and Roswell and Sante Fe, N. M. In all major industrial centers the rust rate is under 4 years.

This was disclosed recently in the first *Rust Index of the United States*, published by Rust-Oleum Corp.

The index, the result of 25 years' research, was compiled in a program in which dated and uncoated steel panels were left exposed at industrial sites throughout the country. The panels were of 28 gage, low carbon, cold rolled sheet steel. Periodic checks provided the data for the index. The criterion was the time it took for a panel to rust severely. ‡



MAP above shows rates at which rust proceeds in different parts of the country. Data was compiled in 25 year research program in which thousands of dated and uncoated 28 gage steel test panels were left exposed at industrial sites throughout the U.S.

Advanced Approach Simplifies Piping Flexibility Analysis

. . . *for process and power piping systems*

In the September issue the author showed how flexibility analyses can be made using the chart solution method and "algebraic method." The use of the high speed electronic computer in completing these same calculations in a fraction of the time is discussed here.

BY EDWIN A. WERT
Engineering & Construction Div.
Southwestern Engineering Co.
Engineers and Constructors

ONE OF THE most significant advances in piping design is the application of high speed electronic digital computers, such as the IBM 650 unit. These superb workers have considerably offset the main disadvantage of the comprehensive hand calculation method described in the September issue — time consumption.

For several years Southwestern Engineering has assigned its design computations to one of these computers, using the Los Angeles IBM Service Bureau Corp.'s scientific computing center. The pipe stress program incorporates the M. W. Kellogg comprehensive analytical method[1,2] for multiple anchorage and other engineering features shown in Figs. 6 through 9.

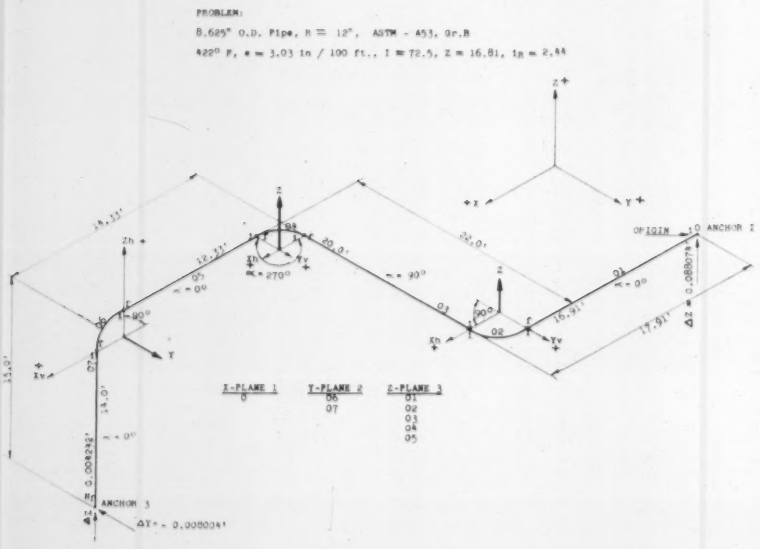
This scientific progress or simplification of manual effort can perhaps be best appraised by contrasting the author's ideal hand methods (desk calculator) with the results obtained using the latest digital computer.

How Computations Are Handled

As with the tabular form method, the IBM's two-program method divides the flexibility analysis into three major parts:

a) The first part of the computations is the determination of the shape coefficients. Essentially, these shape coefficients represent moment of inertia terms of a cantilever system in space. (Reference is made to Figs. 1, 2, and 3 in the September issue.)

b) The second part of the analysis is the solution of a set of simultaneous equations. The set of equations is to be solved for the forces and the moments at the point


PROBLEM:
8.625" O.D. Pipe, R = 12", ASTM - A53, Gr.B
420° F, e = 3.03 in / 100 ft., I = 72.5, Z = 16.81, i_B = 2.44
ORIGIN
ANCHOR 2
ANCHOR 3
X-PLANE 1
Y-PLANE 2
Z-PLANE 3

6 ISOMETRIC DRAWING with data shows identical pipe line in space as in Fig. 1 (September). Same point of origin is indicated, now used for IBM 650 pipe stress program analysis. All data necessary is translated and transferred to forms shown in Figs. 7 and 8. (Figs. 1 through 5 were in the September issue).

7 INFORMATION from isometric drawing, Fig. 6, has been transferred to this geometric data form

MEMBER DATA — PIPE

1 CONT. NO.	2 LINE NO.	3	4	5 R or L FEET	7 X-INITIAL FEET ±	8 Y-INITIAL FEET ±	9 Z-INITIAL FEET ±	10 X-FINAL FEET ±	11 Y-FINAL FEET ±	12 Z-FINAL FEET ±	13	14 ∝ DEG	15 Y DEG
	5	0	0	0	1 3 0	1 6 9	1 0 0	0 0 0	0 0 0	0 0 0	0 0 0	0 0 0	0 0 0
	2	0	0	0	2 3 0	1 0 0	1 7 9	1 0 0	0 0 0	0 0 0	0 0 0	0 0 0	0 0 0
	5	0	0	0	3 3 0	0 2 0	0 0 0	1 7 9	1 2 0	1 0 0	0 0 0	0 0 0	0 0 0
	5	0	0	0	4 3 0	0 1 3	0 0 0	1 7 9	1 0 2	1 0 0	0 0 0	0 0 0	0 0 0
	5	0	0	0	5 3 0	0 1 2	1 3 0	1 8 9	1 0 2	2 0 0	0 0 0	0 0 0	0 0 0
	5	0	0	0	6 2 0	0 1 0	0 0 0	3 1 2	4 0 2	2 0 0	0 0 0	0 0 0	0 0 0
	5	0	0	0	7 2 0	0 1 4	0 0 0	3 2 2	4 0 2	2 0 0	0 1 5	0 0 0	0 0 0

GENERAL DATA — FROM TABLE — FROM TABLES

1 CONT. NO.	2 LINE NO.	3 T_1 °F	4 T_2 °F	5 T_3 °F	6 e °F-1 x 10⁶	7 e °F-1 x 10⁶	8 e °F-1 x 10⁶	9 S_1 PSI	10 S_2 PSI	11 S_3 PSI	12 T °F
	5	0	0	0	4 2 2	0 0 0	0 0 0	0 0 0	7 1 7	0 0 0	0 0 0	0 0 0	7 0

ANCHOR DATA — COORDINATES OF ANCHORS — MOVEMENT AT ANCHOR

1 CONT. NO.	2 LINE NO.	3	4	5	8 X FEET ±	9 Y FEET ±	9 Z FEET ±	10 ΔX FEET ±	11 ΔY FEET ±	12 ΔZ FEET ±
	5	0	0	1	4 3 0	0 0 0	0 0 0	0 0 0	0 0 0	0 0 0
	2	0	0	1	7 3 0	0 1 2	0 1 4	0 0 0	0 0 0	0 0 0

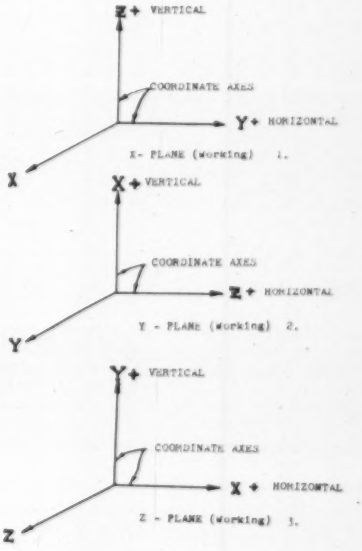
8 THIS is continuance of geometrical data form shown in Fig. 7, above

16 K_b DEG	17 OD INCHES	18 t IN.	19 E_c	20	21	22	23 μ
0	0 0 8 6 2 5	0 1 2 2	2 9 0 0	0	2	0	7 1 3 0 0
0	0 0 8 6 2 5	0 1 2 2	2 9 0 0	0	2	0	7 1 3 0 0
0	0 0 8 6 2 5	0 1 2 2	2 9 0 0	0	2	0	7 1 3 0 0
0	0 0 8 6 2 5	0 1 2 2	2 9 0 0	0	2	0	7 1 3 0 0
0	0 0 8 6 2 5	0 1 2 2	2 9 0 0	0	2	0	7 1 3 0 0
0	0 0 8 6 2 5	0 1 2 2	2 9 0 0	0	2	0	7 1 3 0 0

13 O.D. MAX. IN.	14 t IN.	15 X FEET	16 Y FEET	17 Z FEET	
0	0 8 6 2 5	0 1 2	0 0 0	0 0 0	2

FROM TABLES

13 E_1 PSI x 10⁶	14 E_2 PSI x 10⁶	15 S_H PSI	16 C	17 MEMB. INTO ANCHOR O.D. IN.	18 t IN.	19 ∝ DEG	
2	2 7	4 0 1 7 0	5 2	0 0 0	0 8 6 2 5	0 1 2 2	0 0 2	2
2	2 7	4 0 1 7 0	5 2	0 0 0	0 8 6 2 5	0 1 2 2	0 0 2	2



of origin. In the set of equations the coefficients of the unknown forces and moments are the shape coefficients, and the constant terms express the thermal expansion of the line and the anchor movements. (Reference is made to Fig. 4, September.)

c) The third part is the transferring of the forces and moments from the origin to the points at which the stresses are required and to the anchor points to obtain the reactions. (Reference is made to Fig. 5, September.)

Continuing the pipe stress analysis, reference is made to Fig. 6 showing an isometric which permits the proper assigning of the necessary geometric functions of the designed program, the use of which also enables the designer to make the necessary translation of the data to forms shown in Figs. 7 and 8. The preparation of this input data, while greatly simplified over the hand methods (Fig. 1), is very important and every effort should be made to assign the correct orientation values.

Fig. 6 shows the location of the point of orientation, along with all physical data. For comparison purposes the physical data and operating conditions are the same as those shown in Fig. 1. Each member is assigned a number such as 01, 02, etc. Also, each member is assigned a working plane, such as *X*, *Y*, or *Z*. In Fig. 6 these working plane designations are usually shown in red, as are the *X*, *Y*, or *Z* axes in Fig. 1 representing the torsional members in the previous contrasting problem. The use of color helps minimize errors — especially important ones.

From an inspection of these forms it is seen that the use of a three anchor system is permitted. In the member data field 17 and 18, the OD and wall thickness may be varied. In fields 3, 4, and 5 under general data, the operating temperatures of the different branches may be varied. Coordinate or minus values which are opposite the directions shown by the coordinate axes at point of origin are normally indicated in red.

SECTION	M-B FT-LBS	M-T FT-LBS	S-B PSI	S-T PSI	S-E PSI	S-A PSI	EX. ALL
2-I	2856+	329-	4973+	117-	4979+	29256+	
2-M	2994+		5214+		5214+	29256+	
2-F	2836+	325+	4938+	116+	4944+	29256+	
4-I	3329+	329+	5796+	117+	5801+	29256+	
4-M	3464+	105-	6031+	37-	6032+	29256+	
4-F	3293+	483-	5733+	172-	5743+	29256+	
6-I	855+	483-	1488+	172-	1528+	29256+	
6-M	535+	961-	932+	343-	1157+	29256+	
6-F	201+	1067-	351+	381-	839+	29256+	
1-90	2699+	325-	1927+	116-	1940+	29256+	
3-90	6063+	1067+	4328+	381+	4395+	29256+	

ANCHOR	M-X FT-LBS	M-Y FT-LBS	M-Z FT-LBS	F-X LBS	F-Y LBS	F-Z LBS	
1	307-	189-	2543-	289+	307-	0-	R-H
3	4161-	3937-	1006-	289-	307+	0+	R-H
4							R-C
5							R-C

9 IBM 650 computer 407 print-out sheet delivers piping flexibility data in this form. Machine calculation speeds analyses; results agree closely with data derived manually

This problem has seven members. The time required to complete the geometrical data sheet averages approximately five minutes per member.

The computer analyzes the results and prints out a summary tabulation. The printed results include moment and stress distribution of each bend or elbow and also the moments and forces at the anchor points. The allowable stress range and an indication and location of any amounts exceeding the allowable stress are shown.

Computers Permit Engineering Changes

After the problem has been solved it is possible to make additional changes to the engineering assumptions without interfering with the input data. This can be done by the modification of a limited number of input cards. For instance, external anchor movements can be altered by substituting new punch cards for the respective fields 10, 11, and 12 under the section "movement of anchors." Also, the thermal value of the piping system may be changed. New punch cards would be substituted in fields 3, 4, and 5 located under the heading "general data."

These simple punch card changes permit on-the-spot comparison of a great number of alternative designs. This flexibility of operation adds immeasurably to the success of obtaining the most economical shape of piping structure for the conditions prevailing.

The running time for the complete calculations is approximately six minutes for a two anchor problem and 12 minutes for a three anchor problem, depending on the total number of members in the piping system.

Consider Stress Effect on Flanges

Refer to Figs. 1 through 5 in the article in the September issue. Due to the inordinate amount of tedious calculation, there is a tendency to check for force at the location and amount of maximum stress only. In modern piping systems, the stress analyst will consider effect of moment and forces on turbine and pump flanges. This is necessary because, in many instances, the pumps and turbines would provide resisting forces which have not been provided for directly in the housing design. Also, there are incorporated moving parts with close clearances, etc.

Certain types, or planes of moments affecting this type of equipment may be more serious than others, hence the need for very careful analyzing with the proper assigning of acceptable loadings for the equipment flanges[3,4].

The printed data sheet, Fig. 9, furnishes the moment in the *X*, *Y*, or *Z* working plane at these anchor locations, as well as the amount of *Fx*, *Fy* or *Fz* forces. (Note the close agreement with the identical problem in the September issue.) The program in its comprehensive form furnishes an instantaneous check of the conditions existing at flange connections. These findings could very well be the criterion for design.

The IBM 650 pipe stress program was selected for use by the company because it encompasses a comprehensive exact analytical method for evaluating the stresses and reactions of a complex piping system in space with the minimum of time. The program was designed to handle the vast majority of stress problems that arise in the design of refinery and power piping systems at elevated temperatures.

The use of the high speed digital computer not only helps avoid the inordinate amount of hand calculation, but of great importance is its ability to very quickly analyze piping configurations in the early design stages and with any number of alternate pipe arrangements.

There are some instances where the deflections and lateral movements at right angles to the horizontal axis of the pipe are required. There are others where there are any number of anchors with thermal motion and also with partial or full constraint. The IBM 704 computer has no topological restrictions in making these analyses. The use of this pipe stress program will be described in a future article. ≠

References

[1] *Pipe Stress — Kellogg Method on the IBM 650 Computer*, presented by W. S. Pickrell, J. R. Rogers, and L. S. Woo at the West Coast Applied Science meeting, Los Angeles, August 1955.

[2] *Design of Piping Systems*, M. W. Kellogg Co., 1956, Chapter 5.

[3] *Equipment Stresses Imposed by Piping*, by F. E. Wolosewick, Petroleum Refiner, Vol. 29, No. 8.

[4] *Design of Piping Systems*, M. W. Kellogg Co., 1956, Chapter 3.

Case Histories from a Consulting Engineer's Files

BY C. T. BAKER
Consulting Engineer

Modern air conditioning systems, for efficient and satisfactory operation, must be correctly designed. Here are two typical cases from the author's experience where original design was faulty and had to be corrected.

• the case of the stubborn purger

A REFRIGERATING PLANT purchased a well known make of purger to keep the system free of air. After being placed in operation it operated satisfactorily for an hour or so and then for some reason not apparent to the plant force, it would quit and refuse to perform regardless of attempts to clear up the trouble.

When installing the purger, the small suction line from the drum to the plant suction piping was connected to the suction of the compressor handling the low temperature load.

The low temperature compressor was capable of maintaining −10 F in one room 16 hr a day.

When the temperature was lowered to −10 F, the thermostat would stop the compressor and close the solenoid valve on the line supplying liquid refrigerant to the cooling coils. In tracking down the trouble, it developed that the purger worked fine as long as the low temperature compressor operated, but would stop with the stopping of the compressor.

Since at least one of the high temperature compressors was always in operation during the 24 hr period, it was a simple matter to connect the suction outlet of the purger drum to the high temperature suction line.

This was all that was required to clear up the trouble. The connection to the low temperature suction was removed.

• floor design boosts cooling load

A MODERN air conditioning system in a modern hotel worked satisfactorily and brought the management many compliments from guests who occupied the air cooled rooms, dining rooms, and cocktail bar.

Later, air conditioning was extended to a large assembly room directly above the boiler room, which was on the ground floor. After the addition had been fully completed and the cooling zephyrs from the central system were introduced, the anticipated cooling effect was not fully realized. An examination of this problem disclosed some interesting facts.

The floor of the assembly room, (Fig. 1) which was the boiler room ceiling, was of concrete construction.

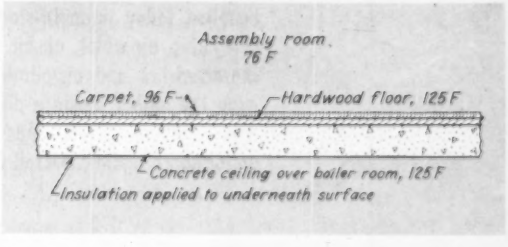
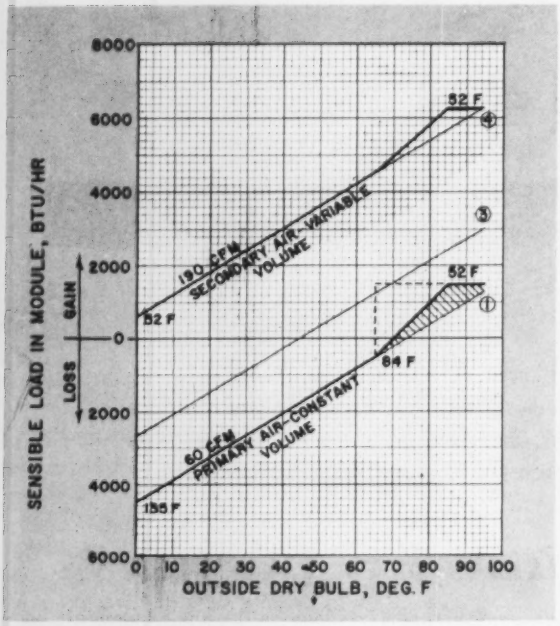


Fig. 2

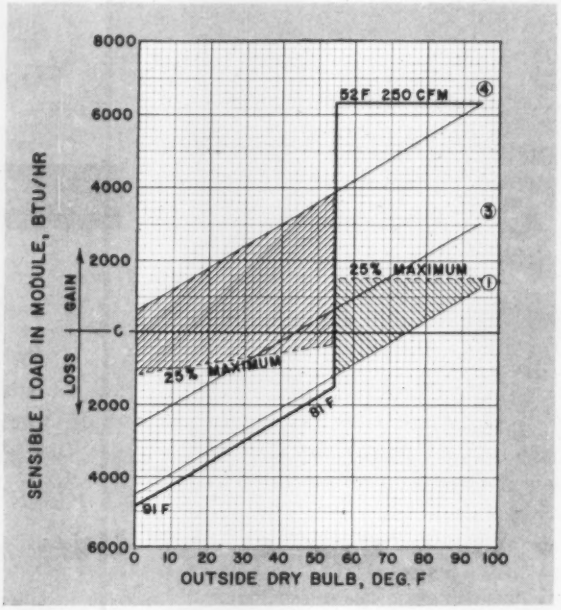
Immediately on top of the concrete was an expensive hardwood floor, which in turn was carpeted with expensive rugs. The temperature of the boiler room measured just below the ceiling was 125 F. This was also the temperature recorded for the top surface of the wood floor. The temperature of the rugs was found to be 96 F. These readings were all made while the room was being cooled from the central plant.

Naturally this boiler room heat added greatly to the load on the air conditioning plant, a condition not contemplated at the time the plant was designed and installed.

The problem was solved by applying insulation to the underside of the concrete. ≠



5 DUAL-CONDUIT system has available heating, cooling capacity as shown. System has constant volume variable temperature air supply to neutralize transmission effects, variable volume constant temperature air stream to offset positive loads. (Figs. 1 through 4 were in the August issue)



6 LIMITED SENSIBLE capacity of single air stream with variable volume and temperature charted here. System must reverse from cooling to heating at 55 to 60 F outside to maintain proper indoor temperatures

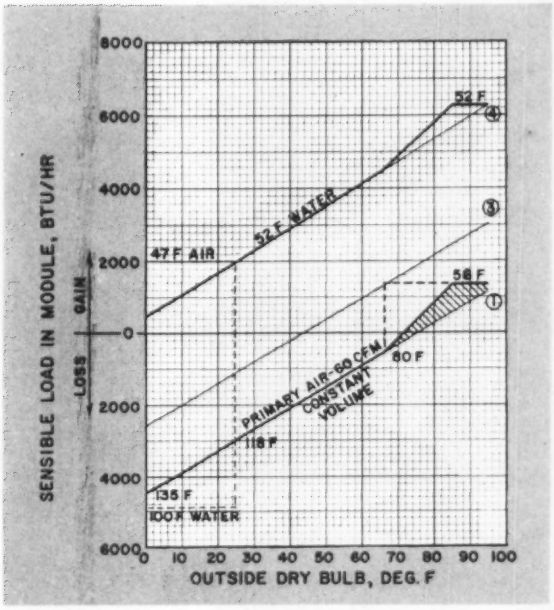
How to Select Right Air Conditioning System for Multi-story Building

The many different types of air conditioning systems that are designed and installed today in multi-story, multi-room structures fall into four main categories: air-water, all air, all water, and refrigerant. Their performance characteristics and installation and operating costs vary. In the August issue the author began a discussion of the various systems that make up these categories. He continues this description here. His purpose? To equate performance against overall cost as a guide to system selection.

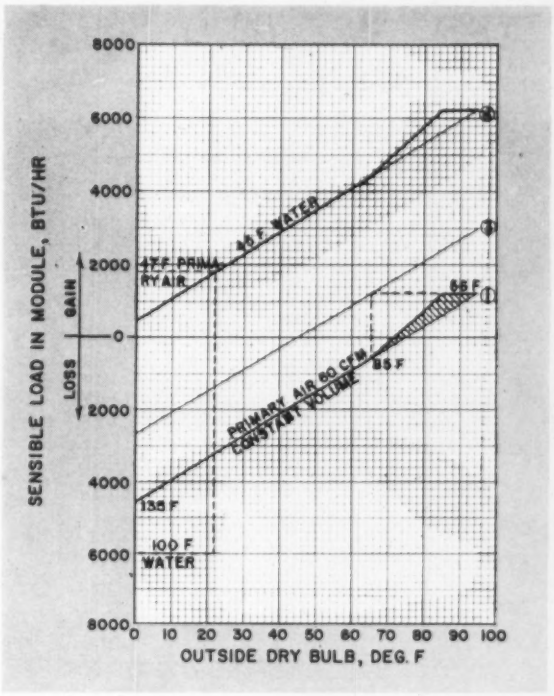
BY M. J. WILSON
Product Specialist
Machinery and Systems Div.
Carrier Corp.

FIG. 5 shows the available sensible heating and cooling capacity in another type of *all air* system. This system has a constant volume variable temperature air supply to neutralize transmission effects, and a variable volume constant temperature air stream to offset positive loads due to sun, lights, and people. This is the *dual-conduit* system.

Several significant features warrant explanation. Note that the same load lines as used in the previous analysis are shown on this chart (No. 1, the unoccupied room; No. 3, the occupied room with lights; and No. 4, the occupied room with lights and sun), as are the scale of outdoor temperature and the scale of heat gains and losses. The potential capacity of the constant volume primary air supply is shown by the heavy line in the lower portion. This is the air supply which neutralizes transmission throughout the year. When the transmission is positive the temperature of the primary air is below the



7 YEAR 'ROUND sensible capacity from *air-water* system with induction terminal illustrated. Condenser water reheat or steam could eliminate overcooling lightly loaded areas



8 ANOTHER *AIR-WATER* system uses fan-coil type of terminal. Supplementary primary air is supplied to each module through separate system

room temperature. At design, it is 52 F, as indicated. The primary air temperature must be reset upward as the outside dry bulb drops, to counteract the effect of transmission.

The area on the right which is enclosed by the broken line represents the overcooling which will occur in an unoccupied room if the primary air is not tempered. Such a condition often prevails if no source of heating is available. During the range of 85 to 65 F outside temperature the air could be heated with condenser water and overcooling reduced to the extent as shown by the shaded area. At 65 F outside, steam would probably be available. Consequently, the required reheat schedule could be maintained.

The potential capacity in the variable volume constant temperature secondary air stream is shown by the heavy line in the upper portion of the chart. This air supply is at 52 F throughout the year. The maximum air quantity from the secondary supply is 190 cfm for this particular module. Recall that the double duct system required 250 cfm of the same temperature air. This system supplies 250 cfm at peak load also, but the difference of 60 cfm is from the primary air system which offsets transmission. If the positive load is something less than design, then the secondary air supply will reduce accordingly.

Assume the load is equal to that shown by Curve No. 3 (occupied room without sun). The secondary air volume will then be reduced to 35 percent of design, or approximately 65 cfm. The total supply to the module would be 125 cfm.

There is an appreciable difference in first costs of distribution systems between the dual-conduit and conventional double duct systems. In one case both trunk systems are sized for 250 cfm per module, but not for the instantaneous demand. The dual-conduit distribution systems are sized for 190 cfm in the cold trunk and 60 cfm in the neutralizing duct.

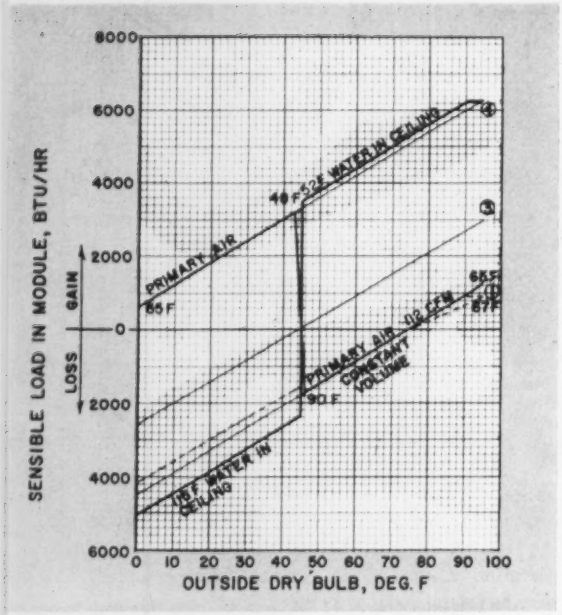
The dual-conduit system is particularly applicable to block type office buildings with large interior areas which have sustained year 'round cooling loads. In such buildings the primary as well as secondary air would be supplied to the exterior zone. Only secondary air, however, would be required for the interior. The change in air volume in the secondary system would be minimized because of the constant load on the interior.

Air-Water System Best for High Sensible Loads

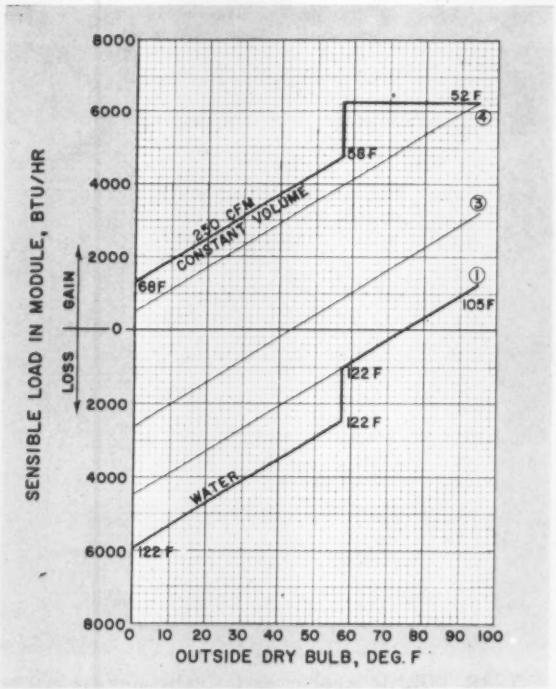
All air systems are better applied in buildings having low sensible cooling loads. Modern buildings with large glass areas and high lighting loads, therefore, can more economically be served by some type of *air-water* system.

As mentioned earlier, this analysis covers 11 different systems which are used for multi-story, multi-room building air conditioning. What are the limited capacities of some of the others?

Fig. 6 shows the limited sensible capacity of a single air stream with variable volume and temperature. Such a system must reverse from cooling to heating at approximately 55 to 60 F outside temperature to maintain proper temperatures in the unoccupied areas and in the occupied areas not exposed to solar radiation. This system does not



9 STILL ANOTHER *air-water* system uses radiant panel type of terminal. Separate air supply is required as in other systems. Air volume is greater to produce acceptable air motion temperature gradient, eliminate possible condensation on panels



10 SENSIBLE CAPACITY of constant volume, single-duct system with *all air* cooling and reheat terminal shown here. From functional standpoint this is best system of all those analyzed

have the capacity flexibility required to maintain the desired temperatures in the various areas.

For example, note the large areas which have been shaded. Overcooling, as shown on the right side, and overheating, on the left after changeover, will occur in rooms on the same exposure. Low limits of volume reduction have been included to show that even then the system is not completely satisfactory. Zoning of such systems by exposure does not give the required flexibility. On some exposures of a commercial office building in downtown areas the moving shadow pattern from adjacent buildings or wings of the same building will produce coincident load extremes such as Curves Nos. 1 and 4.

Fig. 7 illustrates the available year 'round sensible capacity from an *air-water* type of system with an induction terminal. Overcooling of lightly loaded areas which sometimes occurs could be eliminated by use of condenser water reheat or steam during the critical period. The area within the dotted line indicates the possible overcooling which occurs when no source of heat is available. The reheat schedule shown from 85 to 65 F outside could be realized, by using condenser water, and overcooling minimized, as shown by the shaded area.

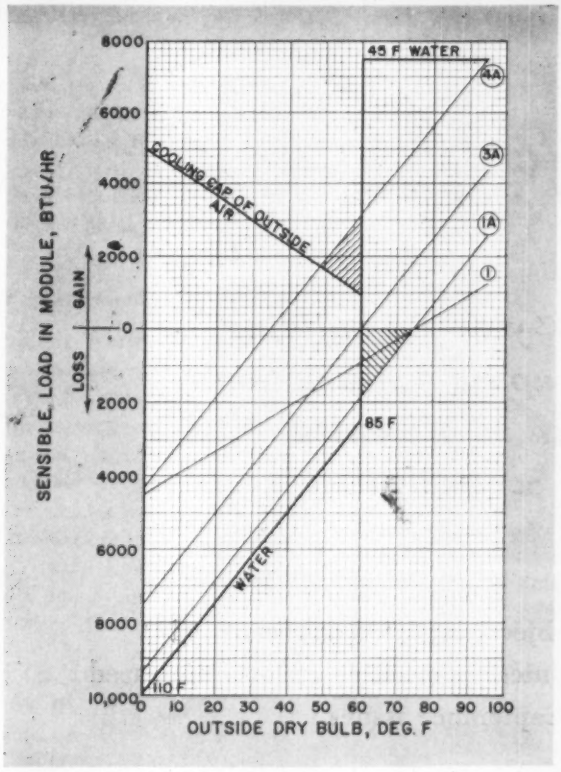
If steam is available when the outside temperature is 65 F, proper temperature of the primary air can be maintained. The total capacity of the units is obtained from both the primary and the secondary air. The net capacity therefore is as indicated by the upper line.

Fig. 8 shows another *air-water* system using a fan-coil type of terminal. Supplementary primary air is supplied to each module through a separate system. The primary air in this case performs the same sensible heat function as that of the induction system. The fan-coil unit provides the necessary air motion and secondary sensible cooling. Functionally, it is the same as the induction system, except for the possible increase noise level due to the fan. The first cost will be appreciably higher than that of the previous system. The operating cost will also be greater.

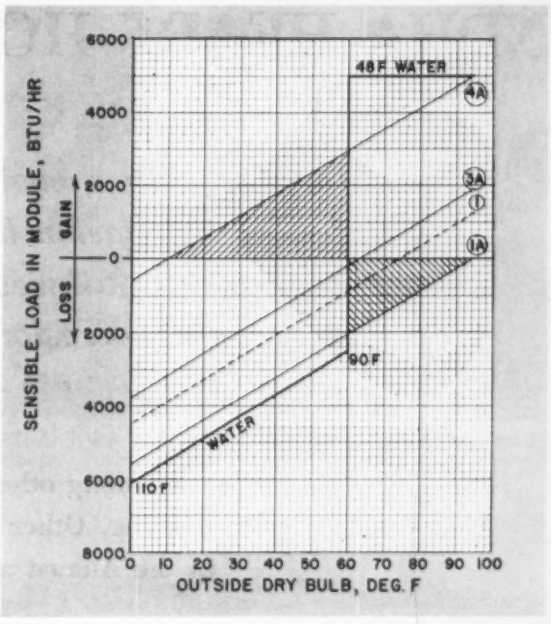
Fig. 9 represents still another type of *air-water* system —this one using a radiant panel type of terminal. A separate air supply is required as in the other systems. The air volume is greater, to produce an acceptable air motion temperature gradient and to eliminate possible condensation on the panels. For this module, 112 cfm is the design quantity.

The results with respect to optimum room dry bulb are substantially the same as the two previous systems. However, slightly different design temperatures are possible because of the radiant heating and cooling effect. The effect on transmission gains and losses due to different inside design conditions is shown by the broken line in the lower portion of the chart. Reversal of system operation could occur at approximately 45 F outside temperature.

This system does have a certain appeal because of its radiant heating and cooling effects. It would reverse at



11 *ALL WATER* SYSTEM using room fan-coil terminal has this limited sensible capacity. System would have single water circuit, outside air intake through wall



12 CHART REPRESENTS sensible capacity of *all water* system using fan-coil terminal with supplementary air from interior zone supply

approximately 45 F outside to realize the full benefits of the radiant panels.

Fig. 10 shows the sensible capacity of a constant volume single duct system with *all air* cooling and reheat terminal. From the functional standpoint this is the best system of all those analyzed—a fact which has been known for years. However, its relatively high first costs and exceptionally high operating costs limit its field of application. This system has practically no limit as to temperature range which may be maintained in the conditioned areas. It has complete flexibility to meet any load condition.

Fig. 11 indicates the limited sensible capacity of an *all water* type of system using a room fan-coil terminal. It would have a single water circuit and take in outside air through an opening in the wall. The outside air quantity, uncontrolled with respect to heating and cooling potential, is established by code requirements and is assumed at constant volume throughout the year. Actually, this is not the case. In tall buildings the stack effect (especially in winter) and outside wind pressures will cause a wide variation in the specified ventilation air quantity. In fact, air flow is often outward—especially on the upper levels and on the leeward side of the building.

The shaded areas in Fig. 11 indicate the theoretical deficiency in heating and cooling when the outside air quantity is 60 cfm. Actual limitations are much greater because of the variable outside air. This air is, in effect, an additional sensible load similar to the transmission gain or loss. The net effect of this additional load is shown by Curve No. 1A, where both outside air and transmission have been added algebraically to give the correct slope of the line indicating outside variables.

Fig. 12 represents the sensible capacity of an *all water* system using a fan-coil terminal with supplementary air from an interior zone supply. This air, in effect, is uncontrolled since it is supplied at the constant temperature and volume required for the interior zone. It does nothing more than reduce the sensible cooling load of the module throughout the year. The actual load is shown by the A curves.

Considerable overcooling, as shown on the right half of the chart, will occur in lightly loaded rooms before changeover. Appreciable overheating results after changeover in areas exposed to the sun. The reader can perhaps recall seeing open windows in buildings having such systems. Of course, there are no openings through the walls and, consequently, stack effect does not change the air quantity as happens with the previous system. The shaded areas, therefore, are good indications of the very limited flexibility in this system.

What are the functional advantages and disadvantages of the different types of systems that are used for air conditioning multi-story buildings? What are their "user benefits?" These factors will be discussed in the concluding article in this series in an early issue. ‡

NDHA HEARS HOW . . .

- ***absorption system cools 27-year-old building***
- ***university expansion has upped consumption***
- ***meter bearing failures can be prevented***
- ***underground corrosion is controlled***

. . . among other subjects reported at recent meeting. Other technical committee reports appeared in the August and September issues.

BY JOHN F. COLLINS, JR.
Secretary-Treasurer
National District Heating Association

RECENTLY the owners of a 26-story office building in Boston selected a steam absorption air conditioning system. Although 27 years old, the building is in excellent condition.

Wesley S. Ehrenzeller, of the engineering consultants on this job, and James W. Megley, of the Boston Edison Co., wrote a paper on the factors entering into the selection of a steam system. This was presented by Mr. Ehrenzeller.

The owners first rejected window unit conditioners because they felt they would be detrimental to the appearance of the building. They next rejected a system consisting of 40 to 50 units from 15 to 20 tons in capacity, because the installation of so many sets of ducts and electric wiring would require a lot of cutting and patching. Also, they would not lend themselves to stabilized room temperature control. Finally a central air conditioning system was selected, leaving the existing heating system intact.

The system includes a central water chilling plant. Chilled water risers extend vertically through the core of the building to the supply and return mains on each floor in the corridors. Cabinet fan units are located just inside the office walls.

In addition, one or more larger cabinet type air conditioning units were installed in storerooms on each floor. These admit outdoor air for ventilation.

It was calculated that 800 tons of refrigeration capacity was required. The owners directed that two 400 ton complete units be designed. They wanted a system which would not require the services of licensed engineers. Therefore, comparative costs of electrical centrifugal machines and steam absorption machines were calculated. On the basis of 600 hr full load operation of the main refrigeration plant and 1200 full load hours for the auxiliaries, the annual energy cost of the steam system was $2500 under that of the electrical system. Maintenance contracts favored steam by 12 percent. Also the installation cost was lower for steam.

Answers to a questionnaire on campus heating sent out to 31 universities by Robert Y. Sigworth, of Gilbert Associates, and Thomas B. Kneen, supervisor of utilities, Pennsylvania State University, co-chairmen of the campus heating committee, were summarized by Mr. Sigworth.

The largest heating plant reporting has a capacity of 520,000 lb of steam per hr. The greatest demand has been 308,000 lb per hr. The 550 buildings heated have a volume of 88,765,000 cu ft. Another system heating only 78 buildings, but larger, heats 95,859,000 cu ft.

Of 19 systems, 14 burn coal, four burn oil, and one burns gas. Boiler pressures vary from 875 to 100 psi. Electricity is also generated at 11 plants.

Eight universities have steam tunnels, seven have tunnels and conduits, and four have only conduits. Distribution pressures vary from 200 to 30 psi. Plant makeups vary from 25 to 4 percent.

Eleven of 19 universities compare steam use with degree days. Some steam is measured at all the plants, but only in seven systems is it all metered. Eighteen percent of the

buildings lack controls. Steam use varies between 0.82 and 2.79 lb per deg day per 1000 cu ft. The high use is at a university where, although there are plant meters, use is not checked per degree day.

Postwar Growth Spurs Additions

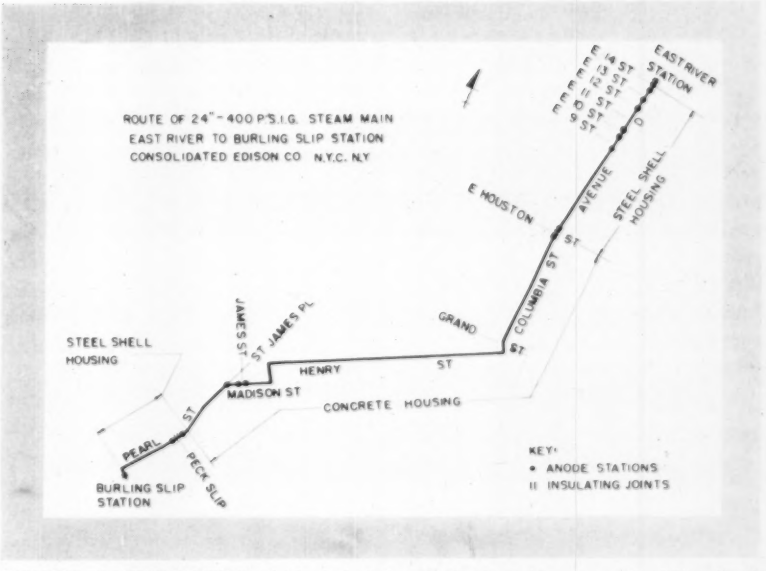
Since World War II the universities have been expanding. More and larger buildings have necessitated additions to steam plants. In other locations, entirely new plants at different sites have had to be built. At the French Lick meeting three reports on university heating plants were made.

Edward J. Gibbons, superintendent of buildings and grounds at Syracuse University, described its new steam plant, which contains at present two 150,000 lb of steam per hr boilers with the latest auxiliary equipment and controls.

Mr. Gibbons was followed by J. C. Sanderson, Jr., director of plant properties at Northwestern University. Mr. Sanderson revealed the difficulties the university had experienced in constructing a new boiler plant for its Chicago campus. The new plant contains two 90,000 lb per hr boilers and other equipment, all up to the minute in design.

The heating problems at Cornell were narrated by Richard G. Karch, superintendent, division of utilities and properties. Cornell's plant is not new, but since 1954 steady progress has been made on a survey which is resulting in improved automatic controls, better metering, more accurate records, lowered costs, and better service.

DETROIT EDISON'S new 6.5 ft ID tunnel, 49 to 62 ft below street level, permits addition of another 20 in. steam line when needed. Cost of completed job was $427,500; piping was $39 per ft



CONSOLIDATED EDISON of New York installed this main to carry 1 million lb of steam per hr at 400 psi from its East River station to Burlingslip station 2½ miles away

Fix Meter Bearing Failures

The steam heating department of the Georgia Power Co. has solved its problem of condensate meter bearing failures caused by carbon and dirt formation. Messrs. W. E. Webb and James C. Thompson of the department reported that carbon formation caused the bearings and bushings to wear rapidly or to freeze the wheels, the ultimate result being a cut wheel or drum ring which had to be replaced.

Mr. Thompson said that, on recommendation of a metallurgist, cold rolled 9/16 in. diameter type K monel was used to produce bearings which were machined to 0.496 in. diameter, smoothed with No. 400 emery cloth, and polished with crocus cloth.

A meter so treated in 1951 was placed in a high-use premises where there had been meter failures several times a year. At the end of five years, after periodic examination, wear on the bearings was about equal to the wear in one year with other bearings.

A somewhat similar problem was reported by Floyd V. Rude, service department superintendent of Duluth Steam Corp. Certain of the company's condensate meters were requiring four or five times as much attention as others. Study indicated that if the diameter of the bearing pins were reduced, the difficulty

might be overcome. Corrosion and foreign matter building up on the large bearing pin surface would increase the frictional drag to the point where the meter slowed up and eventually stopped. Revenue was being lost, and extra time was required in servicing 30 such meters.

Stainless steel meter pins of only 3/16 in. diameter and oil impregnated powdered bronze bushings of proper size were substituted.

Mr. Rude said that at the end of two years' service, 13 of the 15 improved meters tested within the specified accuracy range. The difficulty with the other two was not due to bearing corrosion. The bearing pins and bushings showed practically no wear nor evidence of sticking, so all were put back into service without renewing bearing pins and bushings. Previously the average "in service" time had been around six months, he concluded.

The third paper on the metering committee program was presented by Francis H. Cary, of Builders-Providence, Inc. Mr. Cary described the pressure compensator recently made available as an attachment for his company's meters. This apparatus is designed to automatically correct the integrated reading as the line pressure varies from 50 percent above to 50 percent below normal.

Detroit Edison Expands Service

In 1957 The Detroit Edison Company built a 1391 ft long cylindrical reinforced concrete steam tunnel from an existing shaft just outside its Beacon St. heating plant to an area which will be separated from the present steam system by a proposed depressed expressway, and to one in which there is a large brewery wanting steam service at 130 psi and a new urban renewal housing development as well as good future prospects.

W. R. Yelton, engineering, planning, and layout supervisor of the underground lines department of the company, presented a paper on the subject, written by himself and Messrs. R. B. Black and H. Simpson, also of the company.

Mr. Yelton said that, in spite of its higher first cost, a 6.5 ft ID tunnel with its floor 49 to 62 ft below the street surface and with 10 in. walls was chosen instead of a conduit near the surface. He said the reasons for this selection were:

1) The depressed expressway plans were not complete
2) An additional 20 in. line can be placed in the tunnel when needed
3) A main near the surface would be more difficult, if not impossible, to build under the circumstances
4) There would be a decreased maintenance problem.

Concrete was selected instead of brick for tunnel construction only after comparative bids showed that it would cost less. The shafts above the expansion joint chambers were made of three-ring brick.

For construction purposes, a single shaft was dug down through blue clay and sand at a point approximately midway along the tunnel route, and headings were started in both directions.

Tunnel chamber reinforced concrete walls are 13 in. thick. The chambers contain the expansion joints, leaving the tunnel sections free except for the 20 in. insulated pipe.

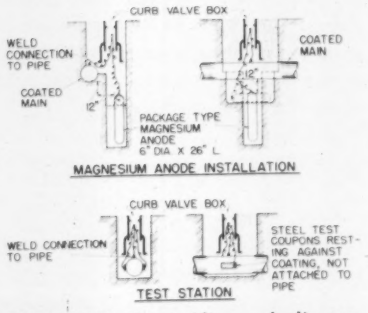
He said that the total cost, including that for tunnel, shafts, piping, and lighting, was $327,500 — or $235.40 per ft, of which $39 per ft was for piping.

Control Underground Corrosion

In 1956 the Consolidated Edison Company of New York City, the utility for which Jerome J. Collins, ND-HA distribution committee chairman, is assistant general superintendent of gas mains and steam distribution, installed a 24 in. steam main to carry 1 million lb of steam per hr at 400 psi from its East River generating station to its Burlingslip generating station 2½ miles away.

J. A. Sheppard, Jr., assistant engineer of the company, described the design and the method of controlling corrosion in the underground steel

METHOD OF INSTALLING MAGNESIUM ANODES



ONE WAY of providing cathodic protection against underground corrosion is by installation of magnesium anodes, as shown above

encased steam main by a combination of coating and cathodic protection. He defined the latter as a method by which the corrosion current can be "bucked out" by an equal and opposite current applied from an external source.

The new New York main was divided into three sections: two end sections installed in tidewater conditions and highly corrosive soil are composed of prefabricated 40 ft lengths of 24 in. pipe encased in 36 in. steel shell; and a center section laid in dry, sandy, noncorrosive soil which was installed in the same way except the pipe is enclosed in a prestressed concrete housing.

A quadruple protective coat, consisting of special enamel, glass fiber, asbestos felt, and rockshield pipe cover, was applied to the steel shell. An electricial test with a detector was made on all prefabricated units to insure that there were no voids nor other defects. Field joints and couplings connecting the shell and pipe units were somewhat similarly protected and tested.

Because the steel shell casing was mechanically and electrically connected to buried slab anchors of steel and concrete and due to the eventual breakdown of the coating, cathodic magnesium anode stations, each consisting of four 32 lb anodes, were placed at pipe anchors and along the main in areas of low soil resistivity. Also, other necessary precautions were taken.

Mr. Sheppard said that from the

tests, two conclusions were reached:

1) Anode design is not an exact science.
2) By measuring pipe to soil potential, the protection being obtained can be decided.

He recommended a standard procedure and remarked that, generally, savings in maintenance and operating costs over a period will far outweigh the initial cost of cathodic protection.

Build Up Pressure Conditions

Mr. Sheppard offered a second interesting paper on the same committee program in which he described how the steam distribution system in midtown Manhattan is being reinforced to improve pressure conditions.

He stated that in the area mentioned (north and south between 42nd and 58th Sts. and east and west between Third and Sixth Aves.) 59 large office buildings have been built or are under construction since January 1957. These have a total rentable area of 18,323,000 sq ft, he said, and added that 13 more such buildings are being planned. All this has resulted in the steam system being heavily loaded.

It was decided that a 20 in. east-west feeder main was needed, preferably at 52nd St. between Lexington and Madison Aves., to deliver steam from the 60th St. and Water Side stations on the East River to the west side of Manhattan island.

Meet Park Ave. Obstacle

Mr. Sheppard said that Park Ave. provided the greatest obstacle because this north-south thoroughfare is a concrete slab supported by the structural steel of the New York Central Railway tunnel. Some of the girders are on 24 in. centers, making it impossible to install a 20 in. line enclosed in its own protective covering. It was also found unfeasible to install two parallel 14 in. lines.

The final selection was a 16 in. line in a 21 in. steel enclosure, increased to 20 in. where the structure permitted.

One scheme abandoned because of the cost of fabrication was an oval shaped steel pipe equivalent in size to a 17 in. circular pipe. The cost of an alternate going down under the railway tracks also was considered and found to be $200,000 more than that of the route approved.

The author said that it is estimated that steam pressure on peak days, which varies from 113 to 127 psi, will increase to between 131 and 134 psi and additional reinforcing lines will not be needed until 1960. ‡

Revolving Heaters Solve Arena's Heating Problem

. . . operate at two speeds

HEATING and ventilating the Island Garden, at West Hempstead, Long Island, N. Y., presented unique problems, according to L. J. Wing Mfg. Co. The huge structure, enclosing a total of 67,500 sq ft of floor space, is believed to be the largest laminated wooden arch building in the world. Similar in shape to the Quonset hut of World War II, the structure rises from the ground at each side to a height of 66 ft at the apex of the arch.

Many kinds of events take place in the arena — from religious revival meetings, boat shows, and Boy Scout jamborees to wild west rodeos and circuses. Attendance at the various events ranges from a high of 10,000 to a low of 5000 for large arena events.

Concealed piping in the floor of the building will permit scheduling of ice sports events. Eventually a bowling alley will be a part of the facilities offered.

Overhead revolving heaters were chosen to heat the building because only four are required. Since the heaters blow the heated air down in constantly moving streams, it is possible to cover 67,000 sq ft without subjecting any section of the floor to a concentrated blast of warm air. Heating is economical because heated air does not stagnate under the roof but instead is recirculated through the revolving heaters.

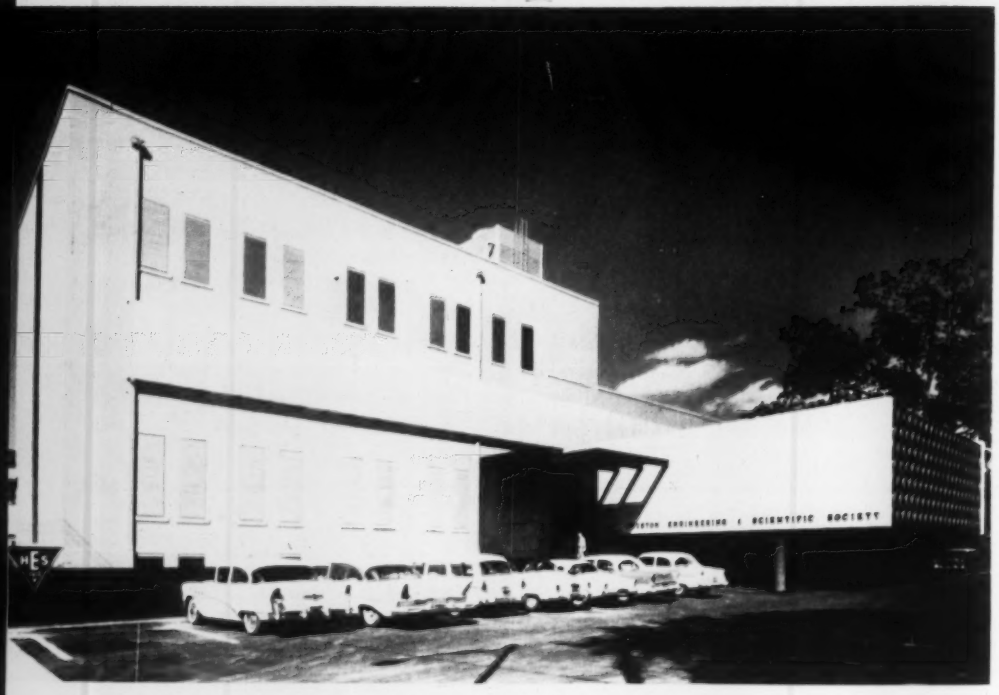
The heaters are suspended from the laminated wooden arches 40 ft from the floor. Steam at 5 psi is piped to the heating elements through 4 in. diameter lines. A two-speed motor driven fan blows air from above the unit down through the heating element and through the two revolving discharge outlets.

Heaters are individually controlled from the floor. Several hours before the arena is to be occupied, the heaters are run at high speed to heat the building quickly. When an audience is present, they are run at half speed, which is sufficient to maintain a comfortable temperature. Motor speeds are controlled manually. In addition, a thermostat shuts off the heaters at the desired temperature.

Each heater delivers about 19,500 cfm. Steam is furnished from a packaged boiler through a 5 in. supply main and a 3 in. return line. Each heater is equipped with stop valves, a trap, and a dirt pocket.

The entrance lobby to the arena is heated by a combination of fixed heaters and diffusers. The air circulates down from the diffuser over to the entrance doors and up through return air grilles to the space between the roof and the hung ceiling. It is then recirculated through the heater. ‡

Gas Generated Steam



Newly enlarged, remodeled 24,433 sq ft structure uses steam from a 3 million Btu per hr boiler for both heating and air conditioning

ENGINEERS and architects duck the heat of southern Texas by relaxing in their new luxurious Houston Engineering and Scientific Society building which is cooled by a central air conditioning system utilizing gas generated steam.

Heart of the automatically controlled system is a 145 ton absorption water chiller, providing all the refrigeration needed to cool the three-story building, which has been enlarged and remodeled to provide an adequate headquarters for Houston engineers, architects, and professional men in allied fields.

The unit is designed to cool the equivalent of 420 gpm from 53 to 45 F. This maintains a constant 75 F temperature with 50 percent RH.

In pointing out the adaptability of the system to meet severe load fluctuations, H. E. Bovay, Jr., principal of the firm which designed the installation, says, "As various rooms in the 24,433 sq ft building are used, the demand for air conditioning may vary widely. For instance, on one night there may be a banquet for 350 people, with plenty of latent heat, and on the next there may be only a relative handful in the lounge. Or the load will shoot up rapidly during a meal, and then drop off gradually as the mealtime ends."

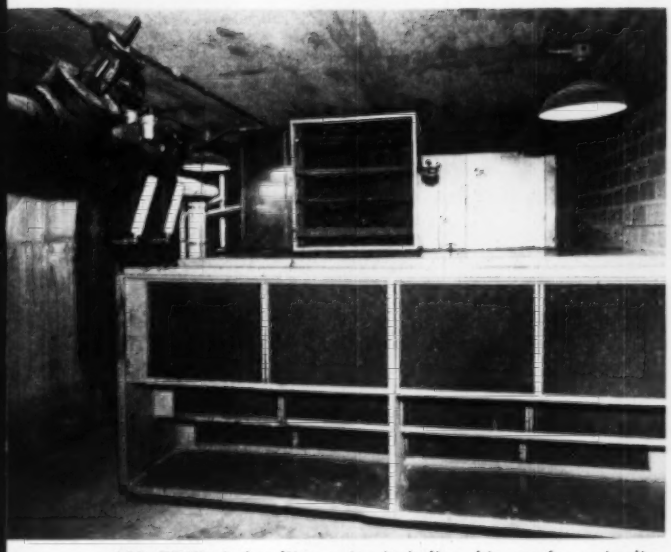
The system, which can operate from 5 percent capacity to full capacity, is ideally suited for meeting such fluctuations, he states.

In the first place, there are five separate low pressure air handling units. The largest, serving the main dining room, can meet a heavy latent heat load. The amount of outside air used is regulated by baffles automatically operated by an outside thermostat and humidistat.

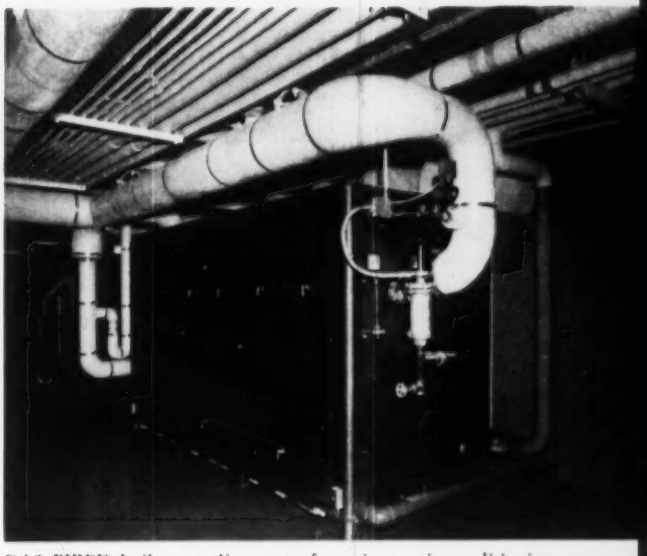
A second system supplies three small meeting rooms on the same floor, while a third unit supplies the entrance hall and several meeting rooms isolated from the others.

Two units are located on the second floor. One serves the game room,

Cools Houston Engineers' Building



ALL FIVE air handling units, including this one for main dining room, have completely automatic controls which permit operation of system from 5 percent to full capacity to meet severe load fluctuations



GAS FIRED boiler supplies steam for primary air conditioning equipment, provides hot water at air handling units to reheat air overcooled during moisture removal. Unit supplies 3000 lb of steam per hr at 15 psig

bar, and main lounge, while the other supplies air to the manager's office and the small dining room where the evening meal is served.

Variations in demand for chilled water are met by variations in the amount of condenser water pumped to the condenser at the absorption unit. Thermostatically controlled valves permit bypassing the condenser water both at the condenser end of the system and at the induced draft cooling tower on the roof.

The cooling tower is capable of handling 525 gpm of water, reducing its temperature from 103 to 86 F.

The gas equipped kitchen is cooled by a ventilation system which pulls 75 F air from the main dining room to replace the air exhausted to the outside. The water chiller and dining room air handling unit are large enough to accommodate this additional load even when all spaces in the building are in use.

Steam from the 3 million Btu per hr gas fired boiler not only operates the primary air conditioning equipment but provides hot water at the air handling units to reheat air which previously overcooled during the moisture removal operation. Hot water from the same system provides heat during cold months.

The boiler, capable of providing 3000 lb of steam per hr at 15 psig, also supplies a steam kettle and a steam cooker in the kitchen, besides generating domestic hot water at 140 F. The water is reheated to 180 F for dishwashing.

The particular nature of the original building from which the club's headquarters was remodeled contributed some advantages and some headaches to the design and installation of the air conditioning system.

For instance, the walls of the building are 2 ft thick and of extremely hard concrete. For that reason, the breaking of holes through the walls was extremely difficult and therefore the mechanical (heating, piping, and air conditioning) contractor kept his requests to the general contractor for break-throughs to a minimum.

These same walls, on the other hand, provide an insulating value and an excellent cold storage effect.

Because the design called for all mechanical equipment to be housed in the basement of the original building, compactness was extremely important. The gas operated water chiller filled the bill, with dimensions of only 4 ft, 10 in. wide × 8 ft, 5⅝ in. high × 14 ft, 10⅝ in. long.

The new building is an all gas installation, utilizing natural gas for air conditioning and heating, as well as for other uses.

The system was designed by H. E. Bovay, Jr., consulting engineers. Wilson, Morris, Crain, and Anderson, were the architects. The mechanical (heating, piping, air conditioning) contractor was the Warren Co. ≠

The Law and Your Profits

BY WILLIAM HURD HILLYER

Beware of "Phantom" Organizations

IN THESE DAYS of grasping for quick money, one must be careful lest he fall into a trap, as did the piping contractor in the following case. Being an honest man himself, he took it for granted that the supposed corporation with which he was dealing actually existed. Here's the way it all happened:

I. M. Klevva and Weir Fellahs, joint real estate developers, took the initial steps to forming Klevva-Fellahs Housing Co-Op, Inc., but did not complete organizing the corporation. They solicited a bid from Pipester Co. for the installation of gas and all other piping in a new apartment building project.

Pipester, never dreaming that the corporation was incomplete, addressed a $20,000 bid on the work to Klevva-Fellahs. This bid was returned to Pipester, penned at the bottom, "Bid accepted:—Date . . . Klevva-Fellahs Housing Co-Op, Inc." It was signed, "I. M. Klevva, Pres."

Pipester went ahead with the contract, collecting for the installation according to agreed terms of "90 percent estimate on the first of each month" — until he came to the final payment of some $1250 balance due.

Klevva-Fellahs refused payment. Pipester sued for that sum, together with a lien, alleging that the so-called Klevva-Fellahs Housing Co-Op, Inc. was a subterfuge to defraud Pipester Co.

Klevva-Fellahs answered with a general denial. The chancellor, unimpressed by the defendant's position, found in favor of Pipester.

Then, Klevva-Fellahs appealed to the state supreme court for a reversal of the decree. They contended (1) that service was not valid on Klevva-Fellahs Housing Co-Op, Inc.; (2) that there was no evidence to substantiate the lower court's findings; (3) that Pipester, not having entered into a contract with the owner of the property on which services were performed, was not entitled to a lien; and (4) that there was no evidence of the alleged subterfuge.

These contentions and denials plainly stemmed from the fact that Pipester undertook the job "in good faith." In point of fact he was dealing with a phantom.

The chancellor had found that Klevva and Fellahs, as individuals, were the owners at all times of the property on which the apartments were built. He held that Klevva-Fellahs Housing Co-Op, Inc. was a dummy corporation which never actually came into existence, but, as alleged by Pipester, was a subterfuge through which Klevva and Fellahs — as individuals — intended to defraud him and defeat his lien on the property.

The chancellor furthermore held that I. M. Klevva "was authorized to bind the stockholders of the corporation and therefore create a lien . . . on the property" involved. The chancery court, reasoning that the incorporators had accepted the benefits of the contract and were therefore bound by its terms, awarded Pipester a judgment for the balance due thereon.

Affirming the lower court's decision, the higher tribunal ruled that the incorporators were bound, whether their corporate status had been completed or not. The general principle was set forth that, where one of the joint land owners induces the performance of services thereon by signing a contract as president of a nonexistent corporation, he and the other owners would be *estopped* from legal appeal.

In addition to the danger of loss faced by our piping contractor (and luckily avoided by him) there is a hazard the other way around. A main object of incorporation is the avoidance of individual liability. As this case has shown, it is quite possible that well-meaning contractors will neglect to complete a corporation (possibly formed for one particular job) and find themselves individually liable in case of an erroneous estimate or some other miscalculation.

Augmenting the main stream of the supreme court's opinion, the learned judges commented at length on various technicalities that might ensnare the unwary when entering into a contract. One of these is the principle of *privity*, by which two or more parties (in our subject case, the chief incorporators) are estopped from denying liability when they act under a common interest.

In plain words, they cannot use—even unwittingly—a corporate semblance to shield themselves from the mischances of an undertaking in which they jointly benefit. ‡

WILLIAM HURD HILLYER, *author of this regular feature, is a contributor to a number of banking and financial publications and has written several books on business. He has an extensive practical legal and financial background.*

This series presents actual cases. All names are, however, fictitious. It should, of course, be remembered that laws vary in different states.

INDUSTRIAL VENTILATION:

How Are Built-up Systems Designed?

In the August and September issues the author stressed the need for careful design and proper application of the components that go into built-up industrial ventilation systems. He detailed system location and casing design, and covered the selection of inlets, dampers, air filters, and air heaters. Here, he discusses how to choose and apply fans and how to design the systems to meet electrical requirements.

JOHN H. CLARKE
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FANS for built-up industrial ventilation systems may be of the centrifugal or vaneaxial type, at the choice of the designer. The selection should reflect the system requirements as to arrangement, pressure, loading, capacity, ease of maintenance, and noise.

Frequently, a noise problem may exist at the system inlet. Here, it may be objectionable to the plant's neighbors rather than manifest itself within the plant. In such cases the system inlet should be designed to minimize noise. This can be done by installing mushroom or canopy inlets in lieu of wall louvers. It may also be necessary to select a quieter fan. Because of the noise that prevails in plant areas, fan noise within the usual equipment levels is seldom a problem. Vaneaxial fans tend to be noisy and in some cases have an objectionable, high pitched whine. This can be minimized by careful selection and design.

The vaneaxial fan is smaller in size and much lighter in weight than its centrifugal counterpart and needs very simple support. In the case of one 50,000 cfm system, it was not practical to hoist and move a large, heavy centrifugal fan to an equipment penthouse. Therefore a vaneaxial fan was chosen and easily moved into position. In addition, it provided a much better arrangement in this particular case because of the straight-through flow it affords.

All of these fans can be selected in either direct or v-belt drive. Ordinarily, v-belt drives are preferred because they permit easier volume balancing. These may be used in explosion hazard areas if the belts are sparkproof, but in many chemical plants and oil refineries, direct drives are the rule in order to reduce the explosion hazard that may exist.

Where belt drives are used, adjustable sheaves (on the motor) are recommended, where practical, to permit speed adjustment. Such sheaves are limited to 5 to 10 hp, depending on the drive. Beyond this point a variable pitch sheave must be used to obtain desired ratios. Consequently, with large fans the system friction (and fan speed) should be checked with particular care. Solid drive sheaves should be provided. Then, if speed adjustment is necessary it is relatively inexpensive to change the motor sheave. This possibility should be kept in mind in setting and wiring the motor. Allow plenty of adjustment in the motor base and plenty of flexibility and adjustment length in the electrical connecting cable to the motor.

Is Corrosion Protection Necessary?

Ordinarily, fan materials are of steel. But where a fan is handling moist air it may be necessary to consider corrosion protection. Fume conditions in many industrial plants can cause serious corrosion problems when moisture is present, even though the fume concentrations are very low and may not be a problem from the standpoint of toxicity or odor. Normal summer atmospheric humidity conditions are sufficient to cause accelerated corrosion in some areas.

Aluminum impellers can be provided at modest extra cost in most cases and the fan casings can be plastic coated (polyvinyl chloride, not less than 0.30 in. thick, preferably a dipped coat). The plastic coatings of fans should be spark tested and carefully protected from physical damage. A superior coating job will result where the fan casing is coated both inside and

The author is a member of the technical advisory committee on industrial environment of the American Society of Heating and Air-Conditioning Engineers. He has written several articles for Heating, Piping & Air Conditioning on the various aspects of design, operation, and maintenance of heating, ventilating, and air conditioning equipment and systems in industrial plants.

out. This eliminates coating edges which are vulnerable to corrosion or loss of adhesion. Multiple coat spraying, when not properly applied, has been a source of trouble and should be carefully checked for adhesion.

The accesses for coated fans should always be of the bolted plate type. Aluminum housings would be desirable in some cases, but the cost of an all-aluminum fan is relatively high. Stainless steel or all-plastic coated fans are also expensive, but they may be justified if the corrosion problem is severe.

It should not be overlooked that nonsparking fans may be required in explosion hazard areas. These are usually available under three categories, as defined by the National Association of Fan Manufacturers:

1) The fan should be made entirely of nonferrous (sparkproof) materials for housing and rotating members in contact with the air stream.

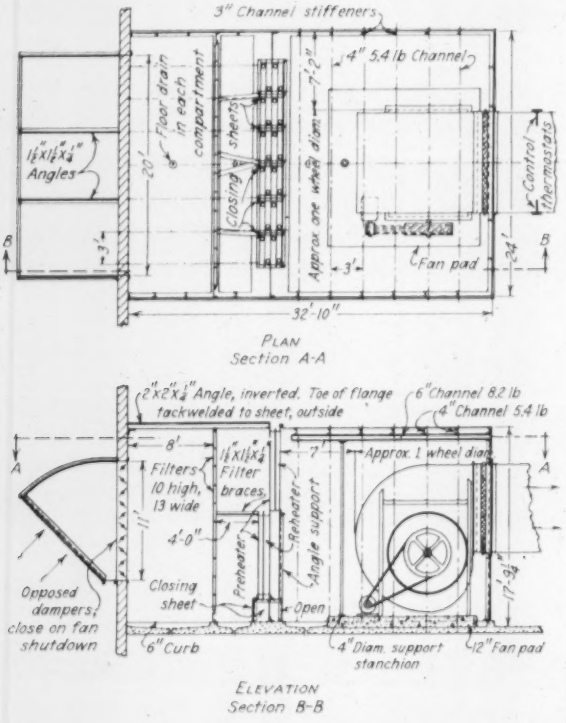
2) The rotating members, inlet cone, and drive side sheet of the casing should be of nonferrous materials.

3) Trim, including the inlet cone and drive side sheet, should be nonferrous—usually aluminum.

The requirements for the specific job should be carefully checked. Most industrial plants having hazardous areas are zoned according to the magnitude of the hazard, and the safety requirements are defined accordingly.

The drive arrangement of the fans is important. Most fans today are belt driven. Of the various belt drives, NAFM arrangement No. 3 for the single inlet fan is probably the most popular because the bearings are arranged on each side of the impeller. This provides a better bearing loading condition. The drive and support also take up less space and are lighter in weight.

This drive has disadvantages, however. On small sizes the inlet bearing interferes with the air flow with the result that most manufacturers do not make this arrange-



EQUIPMENT DATA

Fan:
150,000 cfm @ 2" SP, approx. 340 rpm, 68 bhp, D.W.D.I., CWTH discharge, arrangement No. 3, Class I, wheel size approx. 80".

Motor:
75 hp, 1800 rpm, totally enclosed, fan cooled, induction type, normal starting torque, ball bearings.

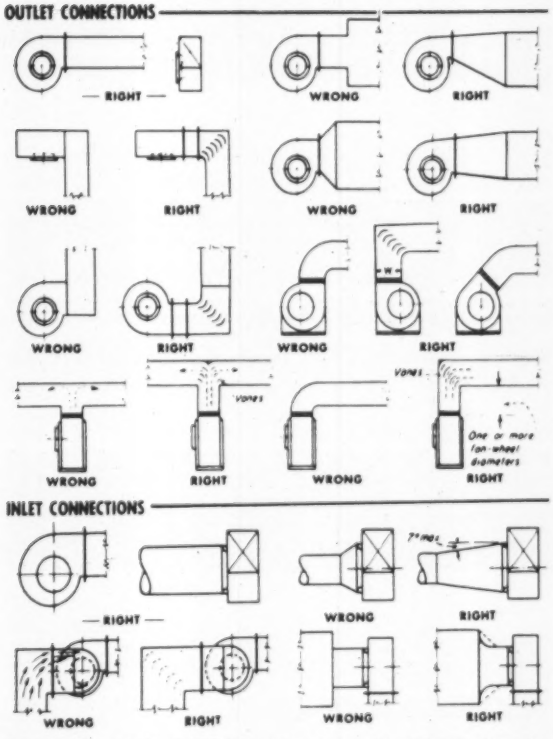
Air heaters:
Preheaters: 12 required, antifreeze type with inner distributing tubes, copper fins and tubes, steam and condensate at opposite ends. One row, 8 fins per in. Overall size 37½" wide X 96" high, face = 32" X 90"
Total face area = 240 sq ft
Face velocity = 625 fpm
Reheaters: Same as preheaters. 12 required.

Filters:
Permanent, oiled, impingement type. Size = 20" x 20" x 2". 130 filters required.

System casing:
No. 14 USSG galvanized sheet steel; vertical stiffeners, 3" 4.1 lb channel; fan compartment beams, 4" 5.4 lb channel; heater support and closing angles 1½" x 1½" x ⅛". Provide access door for each compartment; size 5'-6" high X 2'-6" wide, with 12" sill (6" over curb).

NOTE:
Steam piping brought in at top, condensate removed at bottom. Piping and controls divided to handle six preheaters and six reheaters on each side. Tempering control thermostats in fan discharge would control their respective heater groups by means of sequence control of the preheater and reheater modulating steam control valves.

1a **SYSTEM CASING DESIGN** for 150,000 cfm industrial supply system for tempered, 100 percent outside air, with double width, double inlet fan shown above. It is assumed that steam at 5 psig is available *at air heaters*. Eight fins per in. are indicated for heaters. This number is recommended as a maximum. With higher steam pressures, fewer fins per inch can be used and face velocities can be increased. However, high steam pressures may cause control problems. Each installation should be analyzed for optimum design conditions. Hood, together with opposed dampers, will provide good air flow to filters. Adequate space is required in filter compartment for air flow and filter servicing. Air heaters are stacked to keep tube lengths to safe length for freeze protection. Single row preheaters are indicated for same reason. Note that space of about one wheel diameter is allowed on each side and at rear of fan for proper inlet flow. Two sets of temperature controls—one for each half of heater section—are provided to reduce stratification. Angle and channel stiffeners are shown for casing. This is conventional design. However, for large areas of double inlet fan installation of this capacity, more rigid and less expensive casing could be provided by means of prefabricated, flanged panel sections for the sides and top, bolted into p'ace on the job. Adequate stiffening must be provided for filter and heater sections to withstand pressure differential of each section



7 RIGHT AND WRONG ways to make inlet and outlet connections are as shown here. Good fan performance cannot be expected nor will design capacities be obtained unless these are well designed. Figs. 2 and 3 were in the August issue, and Fig. 4, 5, and 6 were in the September issue

Illustration reprinted from Power Magazine, October 1951

ment in small sizes. On all fan sizes the bearing support requires that the inlet connection or transformation collar be slotted to fit around the bearing support flanges. This is an awkward arrangement. The inlet bearing is also exposed to the dust and fumes in the air stream with the result that it is vulnerable to trouble.

The difficulty is increased by the fact that the bearing is inside the system housing and therefore may get very little attention because of it. Most manufacturers provide oil or grease extensions for this bearing, but this is no positive assurance that the grease reaches it or that it is not overgreased. Overgreasing can easily result in burning up a bearing, although the grease release features of bearing housings are much improved today.

One operator of a large industrial building reported that 80 percent of his bearing failures occurred with the bearings inside of the system casings (NAFM arrangement No. 3 for either single or double inlet fans).

The double inlet fan has the advantage of smaller size and lower starting torque for its capacity. But it has some of the drawbacks of the single inlet fan having the same No. 3 arrangement. With the double inlet fan, both bearings are "hidden" in the system casing and are exposed to the dust and fume conditions of the air stream.

It is my feeling—apparently shared by a great many engineers for industrial plants (particularly chemical, petroleum, and similar industries)—that the most practical fan is the single inlet, arrangement No. 1. In this arrangement the wheel overhangs the bearings, and both bearings are in the open and out of the air stream so as to permit quick checking.

In small sizes, arrangement No. 2, which is practically the same as No. 1 (the two bearings are in the same housing), costs about the same as No. 3. Arrangement No. 2 is not available in larger sizes (above a 36 in. diam wheel —about 14,000 cfm).

I would prefer to use arrangement No. 1 for systems with wheel diameters larger than 24 in. and capacities of about 6000 cfm. This arrangement costs about 20 to 25 percent more than No. 3, but is considered well worth the extra cost in reliability and ease of maintenance. The use of arrangement No. 1 is limited, practically, to about a 72 in. diam wheel. Beyond this point (a capacity of about 75,000 cfm) the bearings and drive should be carefully engineered. Such fans may be excessive in cost, and it will be better to go to either a double inlet fan or a single inlet, arrangement No. 3 fan, depending upon the system discharge requirements. A vaneaxial fan should also be considered if it fits the desirable system arrangement.

Consider Tandem Installation

For large systems where the selection may be a problem or for any system where continuous operation of the supply system is essential to safety, the use of tandem fans (two fans in parallel discharging into a common duct) should be considered. This arrangement is often used because, if a motor or fan failure occurs, some protection is afforded by the capacity of the second fan. Under such circumstances, isolating dampers are needed to prevent short-circuiting through the idle fan.

In such installations nonoverloading fans—either backwardly inclined vane or vaneaxial—should always be used to prevent overload when one fan is down. The fans should also be picked well to the right of the fan curve "hump" to assure stable operating conditions in parallel.

Direct drive fans are used principally in explosion hazard areas, as previously mentioned, and in installations where space is a problem and a light, compact fan is needed. The direct drive fan has been very popular in the maritime field for the latter reason and because d-c power permitted easy speed control. With the marine trend to a-c power, the v-belt drive has become more popular.

Without the speed selection afforded by a belt drive it is difficult to select direct drive fans and their motors for the desired capacity. Where capacity adjustment must be provided with a-c power, either damper control, two speed motors (or both) or a variable speed hydraulic drive must be provided. Direct drive NAFM arrangement No. 8, where the wheel is overhung on its own bearings, is recommended—even though it is bulkier.

Arrangement No. 4, where the impeller is overhung on the motor bearings, is not recommended because the standard motor bearings wear excessively because of wheel unbalance which occurs when the wheel vanes pick

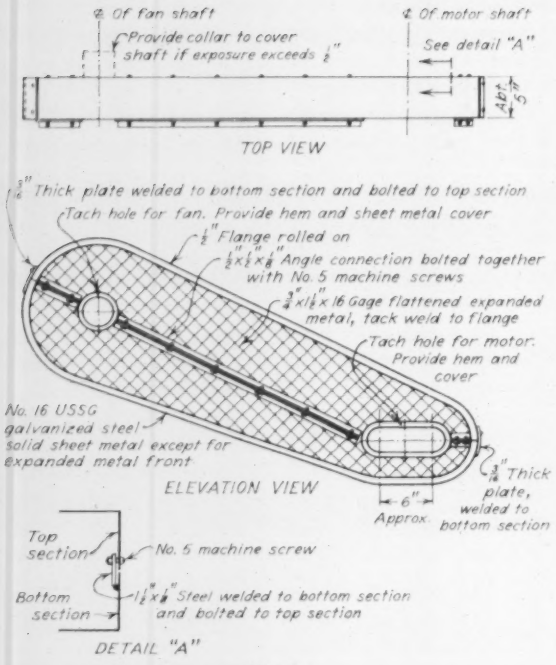

℄ Of fan shaft
℄ Of motor shaft
Provide collar to cover shaft if exposure exceeds ½"
See detail "A"
TOP VIEW
⅛" Thick plate welded to bottom section and bolted to top section
Tach hole for fan. Provide hem and sheet metal cover
½" Flange rolled on
½"x½"x⅛" Angle connection bolted together with No. 5 machine screws
¾"x1½"x16 Gage flattened expanded metal, tack weld to flange
Tach hole for motor. Provide hem and cover
No. 16 USSG galvanized steel solid sheet metal except for expanded metal front
ELEVATION VIEW
⅜" Thick plate, welded to bottom section
6" Approx.
Top section
No. 5 machine screw
Bottom section
1½"x⅛" Steel welded to bottom section and bolted to top section
DETAIL "A"

Fig. 8

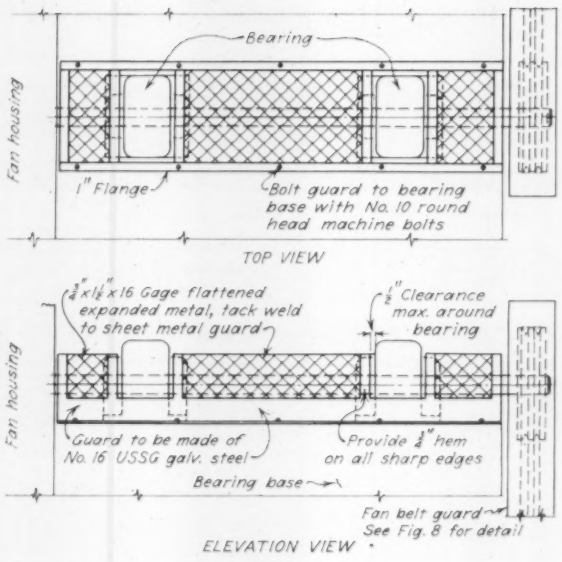

Bearing
Fan housing
1" Flange
Bolt guard to bearing base with No. 10 round head machine bolts
TOP VIEW
¾"x1½"x16 Gage flattened expanded metal, tack weld to sheet metal guard
½" Clearance max. around bearing
Fan housing
Guard to be made of No. 16 USSG galv. steel
Provide ½" hem on all sharp edges
Bearing base
Fan belt guard See Fig. 8 for detail
ELEVATION VIEW

Fig. 9

8-9 GUARDS FOR V-BELTS should have "open" construction to permit observation of belt and grease conditions, reveal any unusual conditions of bearings, permit operator to feel bearings for proper operating temperature. Solid sheet metal guards should never be used

up dirt. In some cases it is possible to buy fans where the motors are specifically designed for the service. Better wear can be expected with such motors. Only arrangement No. 8 is available in large sizes (over 36 in. diam impeller) in any case. Direct drive arrangement No. 7 (similar to No. 3) is not recommended for the essential services for the same reasons as for No. 3. In actual fact, arrangement No. 7 is rarely used.

In all of this discussion on fan arrangements it has been assumed that the fans, whether used for building supply or exhaust, would either be connected to ductwork or to system casings. This would be true with few exceptions.

Inlet, Outlet Design Critical to Performance

All fans are sensitive to poor inlet and outlet conditions. Good fan performance cannot be expected nor will design capacities be obtained in any case unless the inlets and outlets are well designed. Fig. 7 indicates the proper connections for centrifugal fans for most installations.

For system casings for single inlet fans, the transformation included angle to the fan (from the air heaters, cooling coils, etc.) or the projected lines from the equipment to the fan inlet (where the fan is connected into the end of the casing plenum) should not exceed an included angle of 60 deg. An included angle of 90 deg is poor and should not be used.

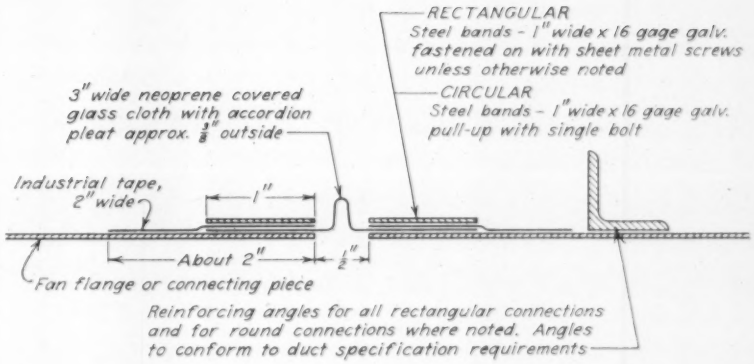
The same inlet conditions should be provided for vaneaxial fans. A straight evenly distributed air supply is very important to the efficiency of these fans. No outlet changes such as branches or elbows should be made for at least two diameters from the outlet. Double inlet fans also require good flow to the inlets. Where installed within system casings, as is almost always done, a space of at least one wheel diameter should be provided on each side of the fan. Also, the back of the fan should be at least one wheel diameter from the air heaters, dampers, etc. In addition, it may be desirable to provide anti-swirl vanes in the inlets. The latter should be specified by the vendor to suit the operating conditions.

Provide for Excess Capacity

A. D. Brandt[1] has called attention to a serious pitfall that faces the design engineer selecting fan equipment. It should always be kept in mind that the catalog capacities are obtained as the result of testing under prescribed laboratory conditions. Such conditions are seldom, if ever, obtained in service. So, it should not be expected that a fan will necessarily meet its catalog capacity. How close it will come will depend upon the quality of the design and installation.

Where it is essential that the fan deliver its design capacity, some allowance should be made either in excess capacity or static pressure to compensate for the operat-

[1] *Are You Getting Good Returns from Your Ventilating Investment?*, by Dr. A. D. Brandt, Iron and Steel Engineer, September, 1956, pp. 92-100.


RECTANGULAR
Steel bands - 1" wide x 16 gage galv. fastened on with sheet metal screws unless otherwise noted
CIRCULAR
Steel bands - 1" wide x 16 gage galv. pull-up with single bolt
3" wide neoprene covered glass cloth with accordion pleat approx. 3/8" outside
Industrial tape, 2" wide
1"
About 2"
1/2"
Fan flange or connecting piece
Reinforcing angles for all rectangular connections and for round connections where noted. Angles to conform to duct specification requirements

10 FLEXIBLE CONNECTIONS for sound isolation at fan inlet and outlet can be made of neoprene covered glass cloth applied with industrial adhesive tape backed up with steel bands. Connection gap need only be wide enough to break metal to metal connection. One-half in. is ample for any job

ing conditions. Capacity deficiencies of 20 percent or more can be caused by poor inlet and outlet conditions. Therefore the problem is worthy of thought. Capacity allowance should also be made for fans having a heavy plastic coating. The manufacturer's representative should be willing to be of help in estimating the capacity allowances which should be made for the various design conditions.

I mentioned in the September article that because of space limitations the duct velocities in industrial areas usually are high, and frequently may be in the range of 4000 to 6000 fpm. Therefore in selecting the fans for such service there is no point in selecting fans having low outlet velocities. Such velocities should not be less than 1800 fpm and should range up to the upper limits (about 2700 fpm) as indicated in the ASHAE Guide for the specific system static pressure.

Must Allow Additional Static Pressure

This brings up another point that is not well understood when high duct velocities are used: *Where duct velocities are increased over the fan outlet velocity, additional static pressure* must *be added in selecting the catalog capacity to compensate for the change in velocity head and the loss in the conversion.*

Let's see how this would work. Assume a required fan capacity of 30,000 cfm operating against a system static (friction) pressure of 1.50 in. water gage. If the outlet velocity of the fan selected is 2200 fpm (this is about the most efficient selection for this size fan), the duct velocity is 4000 fpm, and if the duct transition loss is about 10 percent of the velocity head change, this situation would exist:

Fan static pressure	=	1.50 in. WG
Fan velocity pressure	=	0.30 (equivalent to 2200 fpm)
Fan total pressure	=	1.80 in. WG
System static pressure	=	1.50 in. WG
Duct velocity pressure	=	1.00 (equivalent to 4000 fpm)
Duct transition loss	=	0.07 (10 percent of 1.00 − 0.30)
System total pressure	=	2.57 in. WG

This would mean that if we were to select the fan from the catalog on the basis of 1.5 in. WG static pressure, we would not obtain the design capacity. The *required* catalog capacity should be based on 1.5 + (2.57 − 1.80) = 2.27 in. WG. static pressure, plus any allowance in capacity desired for the job, as previously mentioned. A check should be made of the fan catalog to see what fan discharge velocity (from about 1800 fpm to the full duct velocity) will give the most efficient condition, considering the correction indicated above which must be made for the change in velocity head.

An installation item that should be checked on new fans (and is frequently the cause of lack of fan capacity) is the clearance between the impeller (wheel) and the inlet cone. The higher the operating pressure the more critical this may become, although it can always make a large difference in fan capacity. Frequently, the impellers are shipped separately from the housings or may become loose on the shafts in transit.

Very few workmen realize the importance of, or know the required clearances for the impellers. As a result I have seen such clearances in excess of 1 in. Therefore it is always very important to obtain the proper clearance from the manufacturer for the purposes of future maintenance, and to check the new fan as soon as the installation is complete. Clearance should be proper and *uniform.*

Other Items Should Be Included

There are a number of items which should always be provided for these fans, either by the manufacturer or separately. Fan housing access doors or plates, and drains should be provided, although the latter are omitted on downblast fans. For plastic coated fans, a flat, bolted access plate must be provided to prevent damage to the coating. All fans having bearings within the equipment casing should be provided with grease or oil extensions to the outside. It is my belief that ball or roller bearings are preferable to sleeve bearings in most cases. Ball or roller bearings will usually require grease rather than oil lubrication.

The safety regulations of most plants require that guards be provided for all moving parts. This requires guards for the inlets, shafts, and v-belt drives. Such guards are usually supplied by the contractor to suit the job and the owner's specific safety requirements.

Where the inlet guards are omitted, many plants re-

quire that the fan be locked out electrically before the system casing is entered. Obviously, under these circumstances, bearings inside the casing (NAFM arrangement No. 3 or double inlet fans) would get little attention. This would further contribute to bearing failure. The inlet guard can be made of large mesh screen (1½ to 2 in.) of about 12 gage wire, hemmed and bolted to the fan inlet.

Recommended guards for v-belts and shafts are shown in Figs. 8 and 9. It should be noted that these are "open" guards. Their being "open" facilitates observation of belt and grease conditions, reveals any unusual conditions of the bearings, and permits the operator to feel the bearings for proper operating temperature. These are important factors to keep in mind. Solid sheet metal guards should never be permitted.

Vibration Control Depends on Several Factors

The need for vibration isolation equipment will depend upon the size, type, and speed of the fan, the nature of the building structure, and the extent to which noise and vibration would be a problem for the surrounding areas. If there is any doubt at all, the matter should be reviewed with the manufacturer and carefully engineered. But, in general, where concrete foundations are available for large fans and *welded* steel foundations can be provided for the small fans, these will prevent excessive vibration transmission in most industrial areas. For concrete foundations, the mass under the fan should be approximately three times the weight of the rotating parts and supports.

Another means of sound isolation has been by means of flexible connections at the fan inlet and outlet. In most cases this has been done by means of canvas connections, using about a 6 in. gap between the sheet metal and the fan housing connections.

Workmen frequently defeat the intention of the "flexible" connection by stretching the canvas taut by shrinking it with water. It makes a neat but useless connection and will eventually tear.

I have never been able to understand the logic behind the 6 in. gap which most designers use. All that is necessary is to break the metal to metal connection and to be sure that the connection is *flexible*. A good flexible connection to use is a neoprene covered glass cloth applied with industrial adhesive tape backed up with steel bands, as shown in Fig. 10. It should be noted that the connection gap is ½ in.—ample for any job.

Filter Cooling Air for Open Motors

With very few exceptions, the motors for industrial ventilation fans and air handling equipment should be at least totally enclosed, with fan cooling provided for motors rated over 3 hp. Other enclosures may be required, depending upon the motor size and the area in which it is operating. For applications requiring 100 hp and more, open motors become more practical because of the excessive cost of totally enclosed motors.

For such open motors it is always advisable to provide filters for the cooling air. All electrical starters, controls, thermostats, relays, and allied equipment should also be dustproof (Type 12), or reasonably so (NEMA Type 1-A). Components that are not dustproof can be protected by locating them in dust-tight boxes, either singly or in groups. While these requirements cost more initially, they save considerably in maintenance and add greatly to the reliability of the equipment. There are very, very few places in industrial areas that are dustfree.

In areas where explosive vapors or dusts may be present, explosionproof equipment is required. Sometimes this will require direct drives in lieu of v-belt drives. Where the latter are permitted, they should be of the nonsparking type. In all cases the motors and fans should be grounded.

For remote fans, lockout stop buttons or disconnect switches should be installed at the fans for safe servicing. It is assumed that a disconnect switch is provided for all equipment motors.

The motors for this equipment should be sized to allow a margin for operating conditions such as low voltage, v-belt drive friction, or high ambient temperature. Because nominal errors are involved in estimating system friction, actual fan capacity, and the actual required system volumes, a margin in power capacity should be provided to permit some speed adjustment in order to obtain the required system volume. Low voltage and high belt friction caused by tight belts are not unusual. Totally enclosed motors do not have an overload rating and the power margin should reflect this.

The nameplate power rating of all motors is based on the ambient temperature not exceeding 40 C (104 F). Thus, if the motor operates at higher ambients—which is not uncommon in industrial areas—it can no longer deliver its nameplate rating. Its power may be considerably reduced. Under such circumstances higher temperature insulation should be considered. The difference in cost between standard Class A and Class B insulations is slight. The increase for Class H is approximately 10 percent. The ambient operating temperature should also be considered in selecting operating coil insulation, overload relays, etc. Suitable grease must always be used for lubricating the bearings.

The present day practice of loading motors up to full or to overload rating is usually poor practice because there is no margin of safety. Reliability is sacrificed as a consequence. And reliability is extremely important for these essential applications.

It has been the purpose of these articles on the design of built-up industrial ventilation systems to drive home the need for careful selection of *quality* equipment and to emphasize that first cost is not the proper criterion for such selections. Again, industrial ventilation is a necessity. The ever growing complications of industrial processes and manufacturing have made it imperative as never before that the design engineer judiciously choose its equipment and properly apply it.

Next month this series on industrial ventilation swings over to the subject of heat recovery. ≠

New Chart Sizes Ducts Directly By Static Regain Method

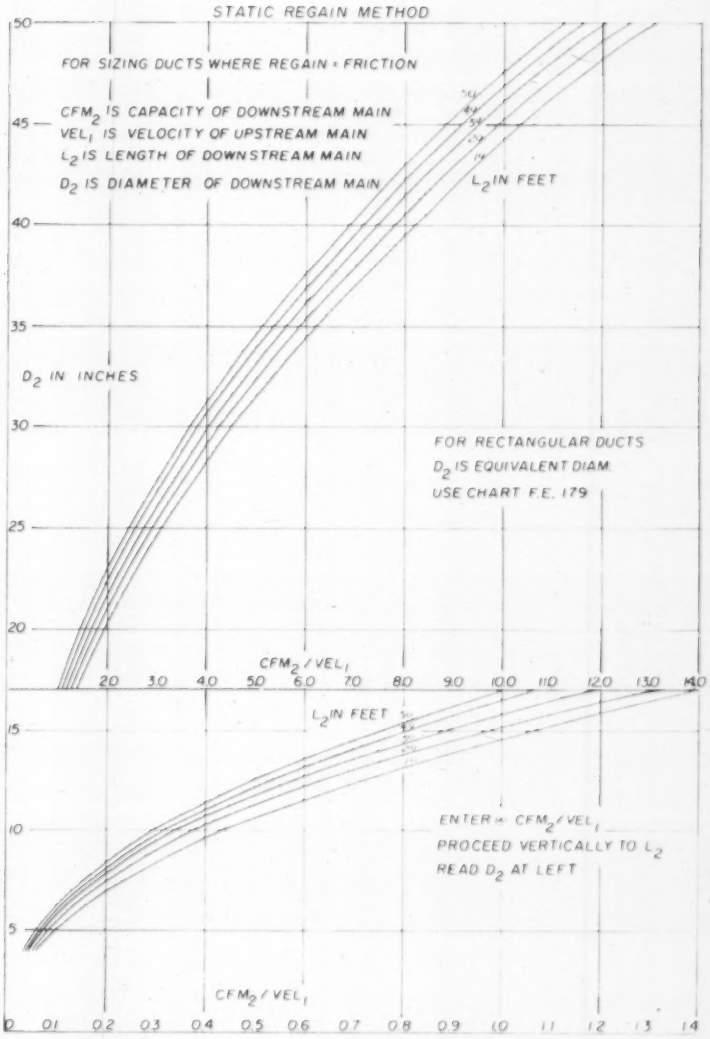
BY R. JORGENSEN
Assistant Chief Engineer
Buffalo Forge Co.

THE CHART given in Fig. 1 can be used directly to size round ducts by the static regain method. These round duct sizes can be converted, if necessary, to equivalent rectangular measurements with the aid of Fig. 2.

Fig. 1 is based on the same values for friction factor and efficiency of regain which were used in preparing the charts which currently appear in the ASHAE Guide. However, it is by *no* means intended as a replacement for the Guide charts.

The new chart is limited to applications involving an exact balance between regain and friction loss, whereas the Guide charts allow for calculations involving either a net gain or loss. Because of this simplification, the new chart is much easier and quicker to use and will very often be found desirable for this reason.

To utilize Fig. 1, one must know the velocity in feet per minute (Vel_1) in the upstream main, as well as the capacity (cfm_2) and length in feet (L_2) of the downstream main in question. It is necessary to assume a reasonable value for the velocity at the head end of the system. This assumption can be based on any number of criteria, including noise con-

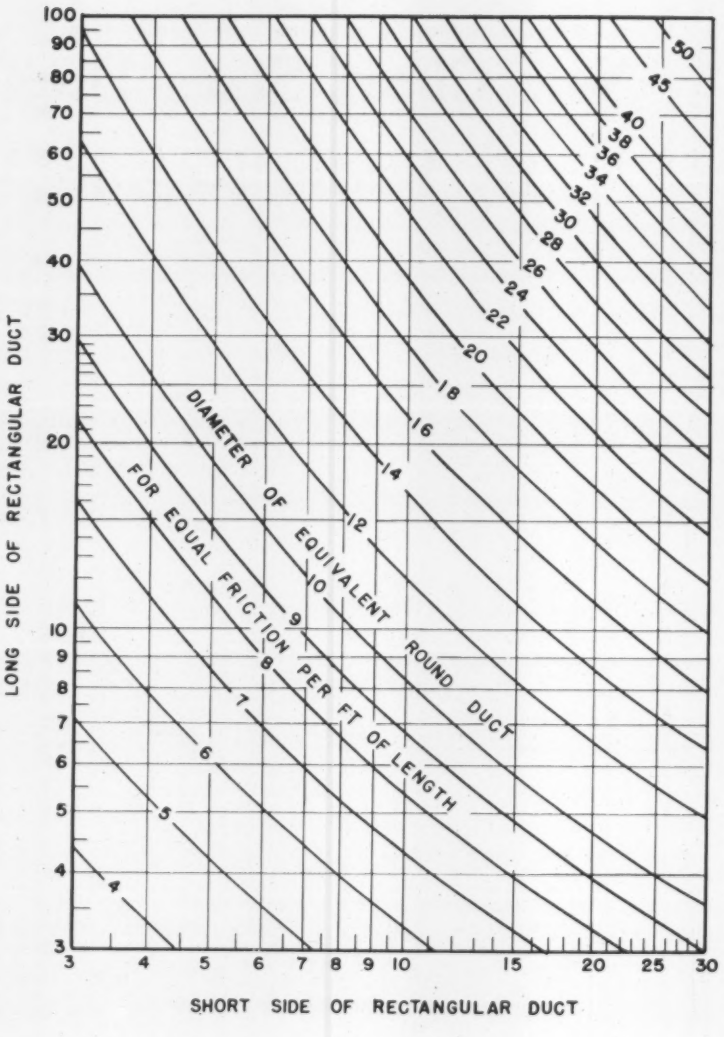

STATIC REGAIN METHOD
FOR SIZING DUCTS WHERE REGAIN = FRICTION
CFM2 IS CAPACITY OF DOWNSTREAM MAIN
VEL1 IS VELOCITY OF UPSTREAM MAIN
L2 IS LENGTH OF DOWNSTREAM MAIN
D2 IS DIAMETER OF DOWNSTREAM MAIN
L2 IN FEET
D2 IN INCHES
FOR RECTANGULAR DUCTS
D2 IS EQUIVALENT DIAM.
USE CHART F.E. 179
CFM2 / VEL1
L2 IN FEET
ENTER @ CFM2 / VEL1
PROCEED VERTICALLY TO L2
READ D2 AT LEFT
CFM2 / VEL1

1 NEW CHART affords quick, easy, direct sizing of round ducts by static regain method. Use is limited to applications involving exact balance between regain and friction loss

Tear out along this line

HPAC DATA SHEET

2 ROUND DUCT sizes derived from Fig. 1 can be converted to equivalent rectangular measurements with aid of this chart. Step-by-step calculation is given in Table 1



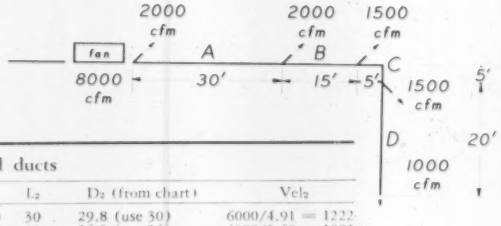
siderations, fan design considerations, etc.

The length of the downstream main can be used directly for L_2 when this section is straight. However, when elbows do occur, it is necessary to calculate an equivalent length. For this purpose it is necessary to assume a duct size. This is no difficult matter, since it can readily be seen from the chart that there is only slight variation of size for variations in equivalent length.

Examples of sizing both round and rectangular ducts are given in Table 1.

The calculations for equivalent length of elbows — both round and rectangular — are based on charts in the 1958 Guide. The values of 10 diameters or eight widths are fairly representative so that many calculations will not warrant further refinements. ⌗

TABLE 1—FOLLOWING TABULATIONS show duct sizing calculations and results for schematic at right, based on Figs. 1 and 2. Note that downstream section of one calculation becomes upstream section of the next



Round ducts

Section	Vel_1	Cfm_2	Cfm_2/Vel_1	L_2	D_2 (from chart)	Vel_2
A	1500	6000	6000/1500 = 4.00	30	29.8 (use 30)	6000/4.91 = 1222
B	1222	4000	4000/1222 = 3.27	15	26.0 (use 26)	4000/3.69 = 1083
C	1083	2500	2500/1083 = 2.31	10+el	Assume 24	
	(Assume that 90 deg el has R/D = 4.0 and four pieces. Then, equivalent L_2 = 10 diam.)					
	(10 × 24/12 = 20 ft, or total of)			30	23.1 (use 24)	2500/3.14 = 796
D	796	1000	1000/ 796 = 1.26	20	16.7 (use 16)	

Rectangular ducts

Section	Vel_1	Cfm_2	Cfm_2/Vel_1	L_2	D_2 (from chart)	Vel_2
A	1500	6000	6000/1500 = 4.00	30	29.8 (use 16 × 53)	6000/5.89 = 1018
B	1018	4000	4000/1018 = 3.93	15	28.4 (use 16 × 46)	4000/5.11 = 783
C	783	2500	2500/ 783 = 3.19	10+el	Assume 16 × 38	
	Assume that 90 deg el has R/W = 1.0 and H/W = 16/38. Then, equivalent L_2 = 8 widths)					
	(8 × 38/12 = 25 ft, or total of)			35	27.2 (use 16 × 42)	2500/4.66 = 537
D	537	1000	1000/ 537 = 1.86	20	20.2 (use 16 × 22)	

HEATING, PIPING & AIR CONDITIONING

JOURNAL SECTION

OF

AMERICAN SOCIETY OF HEATING AND AIR-CONDITIONING ENGINEERS

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President's Message

Progress of the Merger Plan

The Merger Plan is progressing on schedule for presentation to the membership of both Societies. On August 11, 1958 a brief resume of the essential elements of the Plan went forward to all the members. The comprehensive Plan, which was finalized by the two Executive Committees, was sent to all Chapter Presidents and Secretaries on August 20, 1958. The Plan as now developed, although not perfected in all details, is believed to be one that retains the best traditions of both Societies and will be of major benefit to all members of both Societies.

So that the Merger may be adequately discussed in the Chapters, instructions have gone out to the Chapter Presidents and Secretaries to include this item in their Chapter programs in the September, October or November meetings. The September and October meetings are preferred. Assistance if required is being provided by your Society Regional Directors or Council Members.

As you know, consideration and balloting on this important issue will take place in person or by proxy by each member at a Special Meeting of the Society at the Conrad Hilton Hotel, 10:30 a.m. on December 1, 1958. *ASRE* will also consider and ballot simultaneously at their Semi-Annual Meeting in New Orleans.

Your Officers and Council feel strongly that where an issue of such importance is before the membership, that a large representative expression of opinion is essential. You are a part of a membership corporation and the decision on the Merger will be made solely by the membership of the respective Societies. Again you are reminded that a two-thirds majority of those voting in each Society can approve the Merger. Approval of the New York Supreme Court is also required to finalize the Merger agreement.

All members are strongly urged to familiarize themselves with the Plan and discuss it with other members. Participation in Chapter discussions should assist in clarifying questions.

Finally, I should like to urge strongly each eligible member to express his desire in this matter by balloting in person or by proxy.

E. R. Queer

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Information on other Society personnel can be found on page 145

Research on Human Comfort and Environment†

By B. H. Jennings,* Cleveland, Ohio

SUMMARY—Research into human comfort in the air environment of the body has proceeded rapidly in recent years. The mechanism by which the body adjusts its heat output to achieve comfort is reasonably well established and is conveniently divided into zones. Various indexes of comfort are in existence. All are useful but limited in scope. The Effective Temperature Index established by Society research appears to contain uncertainties and to cover a range which might well be extended. Consequently a research facility has been constructed in the Society Laboratory where studies have been started recently aimed at a revaluation of the index and an extension of its range.

NOT UNTIL well into the 20th century did man begin a critical examination and re-examination of relations between himself and his environment. This research has been continuing at an accelerating pace with contributions coming mainly from the engineering and the physiological-medical professions.

The approaches followed by the two groups are necessarily somewhat different. The approach of the engineer is largely subjective. Individuals are subjected to certain environments and their reactions sought, then statistically analyzed to evaluate comfort impressions, response to warmth, coolness, humidity, appearance of sweating, subject temperatures, and the like. The physiological-medical approach adds such items as metabolic testing, pulse-rate measurements, blood pressure responses, rectal temperatures, sweat rates, partitional calorimetry, and the like.

The engineering approach, is particularly satisfactory for analyses and observations in the comfort range or slightly above and slightly below it. However, its adaptability diminishes as regions of thermal heat stress are reached or in the cool and cold range wherein the heat loss exceeds heat generation.

Mechanism of Bodily Response

The range of body response to thermal environment has been examined by many investigators but is perhaps most graphically described in the chart prepared by Keeton, Fig. 1. This chart graphically brings to light the zones of body response. In the neutral zone shown in the center, the body can readily make use of vaso-motor regulation. In vaso-motor regulation, the body can control the manner in which the blood circulates through control of the surface capillaries.

When the limit of control by means of vaso-motor regulation is reached, evaporative regulation comes into play. Under this system of regulation, sweating occurs on the surface of the body, and the evaporation of this moisture in absorbing latent heat acts to cool the body and thereby offset the metabolic heat production and keep the deep-tissue temperature in the desired range. When high air temperatures, combined with vapor pressures too high to permit proper evaporation to take place, the heat produced by the body cannot be dissipated, and body temperature starts to rise. Rise in deep-tissue temperature cannot progress many degrees above 98.6 F, considered normal, before the danger of heat prostration presents itself. The body has some ability to control its metabolic or heat production rate, in addition to the methods of sweating and vaso-motor action; but the control of heat production as such is not particularly significant. It should be mentioned that, even in ranges where sweat is not apparent, a certain amount of evaporation takes place from the surface of the body and during respiration. In general terms, about 24 percent of the metabolic heat produced during resting is dissipated by evaporation with some 15 percent of this occurring at the surface of the skin, with the remainder in the respiratory system.

Environmental Indexes

Researchers have devised a number of ways of presenting and expressing their findings and of making them available in usable form. As a result there now are in existence, and in use to great or small extent, a number of indexes, or scales, for expressing man's reaction to his environment. Space does not permit a complete listing but in this paper the following indexes will be described and briefly discussed:

1. Effective Temperature Index.
2. Equivalent Warmth Index.
3. Operative Temperature Index.
4. Equivalent Temperature Index.
5. The Heat Stress Index.
6. The Predicted 4-Hr Sweat-Rate Index.

It should be noted that of these several indexes the first three use as a reference unit the temperature of still saturated air, and signify that a given rise in saturated air temperature is equivalent to changes in other factors of the environment to produce an equal rise on the index. The limitation of this occurs in warm and hot environments where a numerical change in the index does not reflect in definite form the change in physiological response, and any improvement in the environment cannot be predicted solely by measuring reduction in the index but must be evaluated separately.

Effective Temperature Index

Early researchers at the Society's Research Laboratory developed the

†An abridgment of a paper entitled *A Critique of Current Knowledge and Research Relative to Human Comfort and Environment* presented at a session of the *Congres International de Chauffage et Climatisation*, held in Brussels, Belgium, Sept. 22-26, 1958. The congress has plans for publishing the full text, with references to sources. Mr. Jennings was designated as a Society representative at the congress by action of the Council.

*Director of Research, ASHAE.

concept of effective temperature. This is based upon subjective feelings of equal degree of comfort, hot or cold, under different conditions of air temperature (dry-bulb), relative humidity and air motion. Ultimately their researches were extended to produce the concept of the comfort chart for still air in present use by the Society (HEATING VENTILATING AIR CONDITIONING GUIDE 1958, p. 126, Fig. 10). This has been largely accepted as the best generalization available, in spite of certain limitations of geography and clothing and acclimatization.

The chart also has some other limitations as it was primarily developed for still air, *i.e.*, air moving at velocities normally below the range of observation, or not appreciably above 25 fpm. Moreover, the data were found by employing subjects who moved into and from atmospheres of comparative saturated and test-space air. It was based upon subjects' feelings of equal degrees of comfort, hot or cold, under different combinations of air temperature, relative humidity, and air movement. Lines of equal warmth for subjects at rest, stripped to the waist, were developed for still air conditions and later for various air velocities. Similar tests were also made for clothed subjects at rest and under slight activity. The conditions in one of the rooms were changed until the subjects felt the same thermal sensation in either of the 2 rooms. The reference index value was that of quiet saturated air in which the subject would feel the same thermal sensation as in the actual environment. It was assumed that first impressions reflect the same comfort levels that would be in existence at equilibrium conditions. However, later research indicated that this assumption is not strictly valid, for in an environment of high humidity, some moisture is adsorbed by the clothing and the skin; and when a subject passes to a warmer or to a dryer environment, this moisture evaporates and gives a certain cooling effect which disappears after equilibrium is reached. This phenomenon has the effect of magnifying response to humidity. In the same way, air movement characteristics could alter the response. Moreover, effective temperature as originally measured was based largely on dry-bulb temperature and did not give full significance to radiant conditions in the enclosure.

The Effective Temperature Index, in spite of its inadequacies, has been satisfactory in the comfort range and for the conditions for which it was proposed. However, the slight uncertainties about its basic accuracy at lower humidities and some unmeasured effects of air motion and of asymmetrical radiation temperatures caused a decision to be made that further research on the subject should be conducted by the Society.

Equivalent Warmth Index

This index, developed in England, is based on environmental measures of air temperature, humidity, air movement and radiant temperature. The observations were made on some 2000 workers performing light work in factories of various constructions and having various methods of heating and ventilating during the winter months. Measurements were made using suitable instruments for the environmental conditions and, at the same time, the workers were questioned as to their degree of comfort, and certain skin and surface temperatures were measured. Bedford and his associates then made statistical analyses of the data to correlate the comfort votes with the various warmth factors, and the final result of the work appeared as a single equation; namely,

$$S = 11.16 - 0.0556\ t_a - 0.0538\ t_w - 0.0372\ f + 0.00144\ \sqrt{V}\ (100 - t_a)$$

where

S = a comfort number ranging from 1 = hot; through 4 = comfortable; to 7 = cold.

t_a = the air temperature, Fahrenheit degrees.

t_w = the mean radiant temperature, Fahrenheit degrees.

f = vapor pressure, millimeters of mercury.

V = air velocity, feet per minute.

Over the range of experiments, each of the factors is linear except air velocity. The experiments covered a range of temperatures from 54 to 76 F dry-bulb temperature and went up to 80 F mean radiant temperature. Vapor pressures ranged from 5 to 14 mm of mercury. The range of the experiments is somewhat limited and covers the winter comfort zone and its fringes. In terms of the environmental factors involved, with the help of an alignment chart, it was easily possible to set up the equivalent warmth scale and give thereby an index of environmental conditions. This scale gave more attention to the effect of radiant temperatures than was the case with the original effective temperature index.

Operative Temperature Index

The Operative Temperature Index developed at the John B. Pierce Laboratory of Hygiene at Yale University, is based on a theoretical analysis of heat exchange between a body and the environment and uses partitional-calorimetry approaches. Both the environmental and physiological factors are considered in evaluating the thermal effects between the body and the environment. Over the comfort range for which the index was developed, variations relating to humidity are not necessarily significant, as the major factors are related to dry-bulb temperature, mean radiant temperature, air movement, and body surface temperature, air movement, and body surface temperature. The index calls for a measurement of the surface or skin temperature of the body and also gives a careful differentiation between heat loss by convection and radiation. The effective heat loss by convection increases rapidly with air

velocity whereas the radiant exchange in absolute magnitude is essentially independent of velocity except when the skin temperature changes. A rather complicated series of equations was developed as a means of correlating the variables. An alignment chart makes it possible to use readings of mean radiant temperature, air temperature, and air velocity to give the operative temperature. The index represents an interesting analysis of the environmental problem but is limited by the range covered and by the inability of the index to consider variations in humidity.

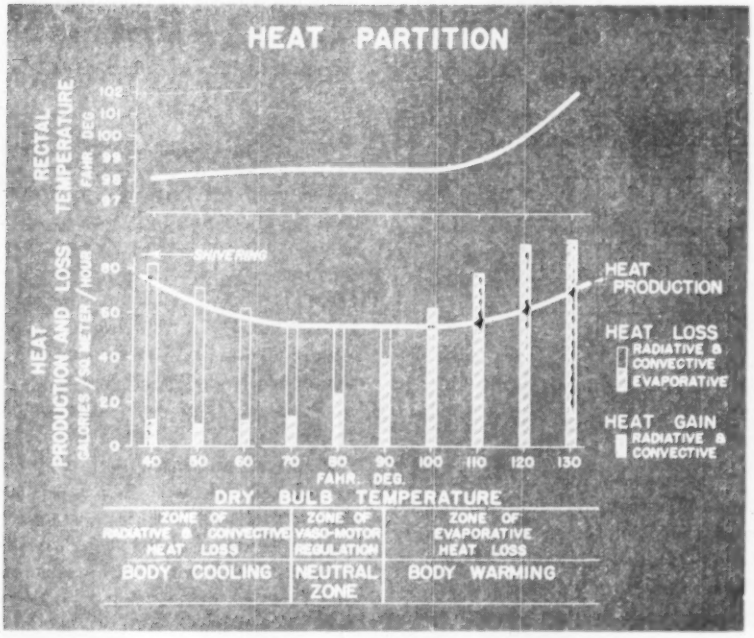


Fig. 1 — Zones of body response to environmental dry-bulb temperature

Equivalent Temperature Index

This index, developed by British researchers, considers dry-bulb temperature, radiant temperature, and air movement. The measurements are made by means of a eupatheoscope. Tests using this index have shown that equivalent temperature in some ways is a better index of warmth than effective temperature when light work is being performed. Unfortunately, the research range was extremely limited.

The Heat Stress Index

The Heat Stress Index is the result from research work carried out by Belding and Hatch at the University of Pittsburgh. To determine this index, theoretical evaluations were made of the heat load on the body under different environments and at different rates of work. Several physiological assumptions were made; namely, that

1. The heat stress imposed upon the body is proportional to the increased demand for evaporation.
2. A constant skin temperature of 95 F is maintained when the body is under heat stress.
3. The maximum sweating capacity of an average man for 8 hrs is one liter per hr, which is equivalent to a cooling load of 2400 Btu per hr.

Using these approaches, the evaluation is expressed in a chart (See THE GUIDE 1958, p. 1106) which enables the heat stress on the body to be determined in relation to a given environment and a given metabolic rate. The index, in turn, is given as a numerical value of heat stress varying from 0 to 200. The value 100 on the index is approximately the upper limit of evaporative regulation and true thermal balance.

The Predicted 4-Hr Sweat-Rate Index

This index, developed in England, used a number of subjects at relatively high temperatures and used the sweat rate in terms of metabolic output and environment as an index of the heat stress on the body. This index and the heat-stress index give a better correlation to other physiological responses under rising dry-bulb temperatures than do the temperature indexes. The range of testing employed was from 80 to 130 F.

Present Status of the Indexes

In addition to the indexes mentioned, a number of other researchers have proposed patterns for measuring the effect of environment on the subject, but none that has been proposed covers a truly extended range. Perhaps it is not necessary that such an index be found, but it certainly would be desirable to have an index which extends to both sides of the comfort range and represents, with accuracy, a delineation of responses and of fundamental environmental factors. The Society comfort chart shows how the Effective Temperature Index operates in the comfort range but does not indicate what effective temperatures mean outside of the comfort range. To extend this aspect of effective temperature, a 7-point scale was suggested by Herrington and Gagge with the characteristics as shown in Table 1.

Confirmation of these values, and extension of the information over a greater range of environmental conditions, is indicated as being neces-

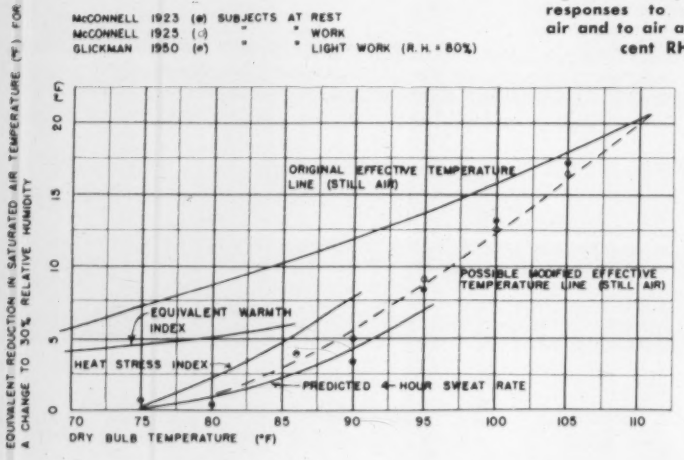
sary for a complete understanding of human reaction to environment.

A number of studies have been made at the Society's Research Laboratory for the purpose of analyzing the existing data in the field of thermal environment. Space is not available to permit a report of all these studies. However, one of the types of studies* is reproduced as Fig. 2. This figure which relates to relative humidity (RH) change is a comparison of the reaction of human subjects from a viewpoint of their own responses and from a viewpoint of their physiological reactions. It is a comparison of 2 environmental conditions; namely, saturated air (100 percent RH) with air at 30 percent RH.

Table 1 — Suggested 7-point scale of effective temperature

	Subjective feeling	Variations in Effective ET Below Optimum	Above Optimum
1.	Cold	9	—
2.	Too cool	6	—
3.	Comfortably cool	3	—
4.	Ideal comfort	Optimum Eff. Temperature	
5.	Comfortably warm	—	3
6.	Too warm	—	6
7.	Hot	—	9

Fig. 2 — Comparison of responses to saturated air and to air at 30 percent RH



The top curve was prepared directly from the Society Effective Temperature Chart for still air. It shows, for example, that if a subject at a dry-bulb temperature of 85 F, in a saturated-air environment, moved into an air environment of 85 F dry-bulb but at 30 percent RH, his feeling would be equivalent to being in saturated air at a temperature 10 deg lower, or at 75 F. Because still saturated air is the reference basis of effective temperature, mention of still saturated air also implies effective temperature as well.

The second curve on this chart is the Equivalent Warmth Index. It will be noticed that this index, in its limited range, indicates a relatively smaller change between saturated air and 30 percent RH air at the temperature for which it is applicable. Further down in the chart 2 physiological-type indexes are plotted; namely, the Heat-Stress Index and the Predicted 4-Hr Sweat-rate Index. It will be noted that both of these also indicate a smaller response change between saturated air and 30 percent relative humidity air. Finally, on this chart direct experimental data involving some subjects are plotted. These also point to the fact that the effective temperature as customarily represented indicates a larger difference between the selected relative humidity conditions than is probably the case.

Consequently, these data would seem to indicate the advisability of changing some ranges of effective temperature to lower values; and a possible modification for one set of conditions has been drawn on the figure. The author is not recommending that this or any modified curve be used until it is more completely and experimentally justified, but there is evidence to indicate that some correction to the currently used Effective Temperature Index may be in order. In defense of the index, however, there is indication likewise that certain of the other indexes do not represent with complete accuracy the human responses believed to hold over the range of temperatures in customary environments.

Research in Progress

The need for further research in the field of man and his environment was so apparent that the Society has constructed a new research facility (See JOURNAL SECTION, January 1957, p. 204) in its Research Laboratory to make possible a more comprehensive study of man and his environment than had been made before.

A long-term program of environmental research is anticipated. The first part of the program, now under way, is being carried out on the influence of thermal environment on the comfort of sedentary workers and on sedentary subjects at rest. The results of these tests should provide definitive data for all regions of the comfort chart. Subsequent test programs will include studies involving symmetrical and asymmetrical radiation, a determination of optimum conditions for comfort at different work levels, and it is finally hoped that some definitive conclusions can be reached regarding measures of human productivity or occupational efficiency as related to environment. This type of study might also be profitably carried over to study desired conditions in schools to find whether the rate of learning is appreciably influenced by environmental conditions. Results will be published as rapidly as found.

*Study made by Baruch Givoni.

Frost Formation and Heat Transfer on a Cylinder Surface in Humid Air Cross Flow

Part II — Theoretical Study and Conclusions

By P. M. Chung* and A. B. Algren **, Minneapolis, Minn.

SUMMARY—This paper is the continuation of Part I — Experimental Study.

Steady-state heat and mass transfer processes are first studied through existing solutions of boundary layer equations, and through the heat and mass transfer analogy. Equations describing the variation of heat transfer with respect to time are derived with certain assumptions. A set of equations are also derived which describes the diffusion process of vapor through the frost formed.

The solutions of the equations thus developed are studied in the light of the experimental data reported in Part I and existing data from previous investigators.

Finally, an attempt is made to find the major parameters which influence the process of heat transfer with frost formation.

IN A FLOW of air normal to the axis of a circular cylinder, a laminar boundary layer exists along the surface of the approach side up to the boundary layer separation point. The boundary layer becomes turbulent just before the separation at high Reynolds Numbers. For most engineering work only the laminar boundary layer exists, and it separates approximately at 70 deg measured from the stagnation point. Following the separation, the Karman Vortex wake is formed[15].

Mathematical analyses of flow and heat transfer, as well as the experimental analysis, have been carried out by several persons along the laminar boundary layer. However, only the experimental data are available for the surface of the cylinder downstream from the separation point. The following 3 boundary layer integral equations are available for steady-state flow, heat transfer, and mass transfer respectively, along the laminar boundary layer.

$$U_0\frac{dU_0}{dx}(l^*+2l_i)+U_0^2\frac{dl_i}{dx}-V_wU_0=\frac{\mu}{\rho}\left(\frac{dU}{dy}\right)_w \quad \cdots\cdots(1)$$

$$\frac{d}{dx}\int_0^{l_t}U(t_0-t)dy=\alpha\left(\frac{dt}{dy}\right)_w+V_w(t_0-t_w) \quad \cdots\cdots(2)$$

$$\frac{d}{dx}\int_0^{l_m}U(W_0-W)dy=\mathfrak{D}\left(\frac{dW}{dy}\right)_w+V_w(W_0-W_w) \quad \cdots\cdots(3)$$

In Equation 1, μ/ρ is the kinematic viscosity, and l^* and l_i are the displacement and the momentum thickness respectively.

Equations 1 and 3 were solved[22] for the evaporation of water, and for the general process of diffusion from a flat plate to a gas stream[23]. They were also solved for a stagnation point of a sphere in the same paper. All three Equations 1, 2 and 3 were solved in connection with the frosting flat plate[14]. In all these solutions the Karman-Pohlhausen-Kroujiline method[24] was used. Accurate solution of the 3 equations for the laminar region of a circular cylinder is possible, but is tremendously complicated and time consuming. Moreover, the steady-state solution thus obtained will not be of much value for the problem of frost formation which is essentially a transient situation.

Without solving the 3 equations directly, the following studies were made to evaluate the heat transfer along the laminar boundary layer with mass transfer.

The concentration of water vapor involved in the process of frost formation is small. Therefore, the magnitude of V_w is also small and can be neglected in the solution of the equations without appreciable error. Several approximate methods of solving Equations 1 and 2 for $V_w = 0$ have been devised by various people for different cylinder profiles. In References 24 and 25 the now well-known method of the equivalent wedge-type solution of a heat transfer problem is presented. This method utilizes the existing solutions along wedges with the flow represented by the equation $U_w = (\text{constant})\ X^m$. The heat transfer along the laminar region of a circular cylinder was solved for A = 0.70.[24] The Prandtl number is found to be 0.715 for the condition of the air in the present study. The sensible heat transfer coefficients along the cylinder surface are calculated here for Pr = 0.715 with the help of the pre-drawn curves found in Reference 24. These values are shown in Fig. 17.†

For $V_w = 0$, Equation 2 for the heat transfer and Equation 3 for the mass transfer are similar. The solutions of the equations, hence, also could be expected to be similar. Through the dimensional analysis with Equations 2 and 3, and through numerous experiments (References 21 and 26 through 31), the following general relations are known today:

$\text{Nu} = f_1(\text{Pr}, \text{Re})$, for heat transfer, and
$\text{Sh} = f_2(\text{Sc}, \text{Re})$, for mass transfer.

The functions f_1 and f_2 are more or less the same. For geometrically similar cases f_1 is equal to f_2 if Pr = Sc. Generally, however, it is also extended to cases where Pr is not exactly equal to Sc.

*Assistant Professor, Department of Mechanical Engineering, University of Minnesota.
**Professor, Department of Mechanical Engineering, University of Minnesota. Member of ASHAE.

[15]Exponent numerals 22 to 33 refer to References at end of this paper; exponent numerals 21 and lesser refer to References in Part I (ASHAE JOURNAL, September 1958, pp. 171-178).

For presentation at the 65th Annual Meeting of the AMERICAN SOCIETY OF HEATING AND AIR-CONDITIONING ENGINEERS, Philadelphia, Pa., January 1959.

†Figure numbers in Part II of this paper are numbered 17 to 30, inclusive; Figs. 1 to 16, inclusive, are in Part I (ASHAE JOURNAL, September 1958, pp. 171-178).

For the small concentrations of water vapor and temperature difference involved in the present study, either the partial pressure or concentration difference of water vapor may be used as the driving force in mass transfer.

The general method of approach to the problem of simultaneous transfer of heat and mass was discussed[21] and this general method, with some modifications, is applied here to the laminar region of the circular cylinder. The principle of heat and mass transfer analogy, and previously calculated values of heat transfer coefficients shown in Fig. 17 aided in derivation of the following equations.

There exist velocity, temperature, and partial pressure gradients in the direction normal to the surface near the surface. For the sensible heat transfer at the surface:

$$K\left(\frac{\partial T}{\partial y}\right)_w = h(T_o - T_w) \quad \text{.....(4)}$$

Now,

$$\frac{Nu}{\sqrt{Re}} = \phi\left(\frac{x}{D}, Pr\right) = \phi\left(\frac{x}{D}, 0.715\right)$$ was calculated in Fig. 17.

Therefore Equation 4 becomes:

$$K\left(\frac{\partial T}{\partial y}\right)_w = \frac{K}{D}\sqrt{Re}\,\phi\left(\frac{x}{D}, Pr\right)(T_o - T_w) \quad \text{.....(5)}$$

From the heat and mass transfer analogy:

$$Sh = f_2(Sc, Re) = f_1(Sc, Re),$$ therefore

$$\frac{Sh}{\sqrt{Re}} = \phi\left(\frac{x}{D}, Sc\right).$$

At the average temperature of the air at 30 F encountered here, Sc = 0.677. Therefore $Sh/\sqrt{Re} = \Phi\ (x/D$ 0.677) was also calculated by the equivalent wedge method, and is presented in Fig. 17.

For the mass transfer at the surface with the aid of Fick's Law:

$$\left(\frac{\partial C}{\partial y}\right)_w = \left(\frac{\sqrt{Re}}{D}\right)\left(\frac{1}{R_v T}\right)\phi\left(\frac{x}{D}, Sc\right)(P_o - P_w) \quad \text{.....(6)}$$

It is known that as the diffusion of water vapor proceeds through the laminar boundary layer, a secondary convective current is set up. This phenomenon is analyzed[21] and the study of this secondary current yields:

$$V_w = m_w\ R_v\ T_w/P_t \quad \text{.....(7)}$$

$$\text{and } \left(\frac{\partial C}{\partial y}\right)_w = \frac{m_w}{\delta}\left(1 - \frac{P_w}{P_t}\right) \quad \text{.....(8)}$$

and Equation 5 becomes:

$$m_w\left(\frac{x}{D}\right) = C_m\left(\frac{x}{D}\right)(P_o - P_w) \quad \text{.....(9)}$$

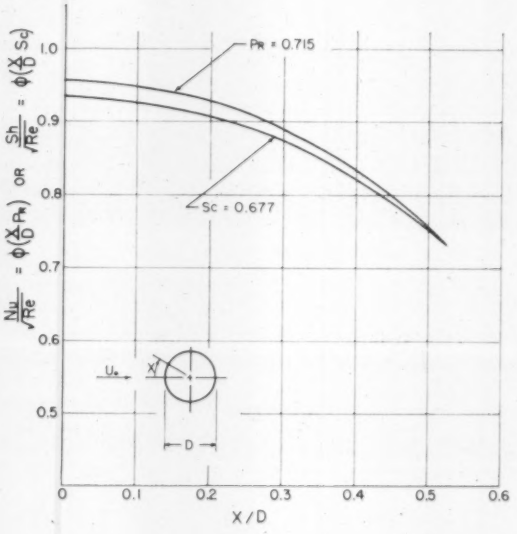


Fig. 17 — Theoretical values of Nusselt and Sherwood Numbers along the laminar region of the cylinder (calculated by the method in Reference 24)

Part II Nomenclature

The following symbols are used in this paper (Part II) in addition to the Nomenclature in Part I (see JOURNAL SECTION, September 1958, p. 174):

y = distance measured normal to the cylinder surface.
U_o = free stream velocity.
T = absolute temperature, in general, or at the frost-air interface.
W = specific humidity, in general, or at the frost-air interface.
D = diameter of the frosted cylinder.
r = radius of the frosted cylinder.
τ = time.
m = mass transfer.
q, Q = heat transfer.
C = concentration of vapor.
K = thermal conductivity.
α = thermal diffusivity.
μ/ρ = kinematic viscosity; μ = absolute viscosity.
h = coefficient of heat transfer.
h_m = coefficient of mass transfer.
V = velocity in y direction.
R = gas constant.
he = total heat transfer coefficient defined by: Q_t/Surface area = $he\ (e_o - e_w)$.
e = $1.136\ C_{pf} + LW$ ... (See Part I).
M = molecular weight of mixture.
P = partial pressure of vapor.
l_t = thickness of thermal boundary layer.
l_m = thickness of diffusion boundary layer.
t = temperature, Fahrenheit degrees.
$\Theta(x/D, P_r)$ = a particular function of x/D, and P_r.
$n, C_1, C_2, C_3, a, b,$ = constants defined in the text.
(x/D) in mw (x/D), C_m (x/D), etc. . . . shows that mw, C_m etc. are functions of x/D.

Subscripts

o = free stream conditions.
w = surface conditions of the bare cylinder.
f = frost.
V = vapor.
T, = total value.
x means in x direction.

$$\text{where } C_m\left(\frac{x}{D}\right) = \left(\frac{\delta}{DR_v T}\right)\sqrt{Re}\left[\frac{\phi(x/D, Sc)}{1 - (P_w/P_t)}\right] \quad (10)$$

The total heat transfer per unit area along the laminar boundary layer is:

$$q_t\left(\frac{x}{D}\right) = K\left(\frac{\partial t}{\partial y}\right)_w + V_w(t_o - t_w)C_{pf}\rho + m_w L \quad \text{.....(11)}$$

$$\text{now } \frac{R_v T_w \rho}{P_t} = \frac{M}{M_v} \quad \text{.....(12)}$$

Substitution of Equations 5, 7, 9 and 12 into Equation 11 yields Equation 13, thus

$$q_t\left(\frac{x}{D}\right) = C_n\left(\frac{x}{D}\right)(T_o - T_w) \quad \text{.....(13)}$$

$$\text{where, } C_n\left(\frac{x}{D}\right) = \frac{K}{D}\sqrt{Re}\,\phi\left(\frac{x}{D}, Pr\right) + C_m\left(\frac{x}{D}\right)\left[\frac{M}{M_v}C_p + \frac{L}{T_o - T_w}\right](P_o - P_w) \quad \text{.....(14)}$$

The preceding analysis does not apply for the surface of the cylinder downstream from the boundary layer separation point.

Through extended studies, Colburn[26-30] established the general analogy between heat and mass transfer processes as stated in Equation 15, thus

$$\text{Stm/St} = (\text{Pr/Sc})^{2/3} \quad \text{.....(15)}$$

The Stanton number ratio was calculated and was compared to the experimental value for the entire cylinder in Part I.

Variation of Total Heat Transfer with Time

Here, the transient process of heat transfer effected by the growth of the frost layer on the cylinder surface is studied. The process here is extremely complicated. Since the heat and the mass transfer coefficients are not uniform over the cylinder surface, each position along the surface will go through different mode of variation of conditions with time. Strictly, the cylinder ceases to be a circular one as frost is being formed on its surface (See Fig. 15, Part I). The Reynolds number and thus the transfer coefficients also vary with the change in the geometry of the cylinder profile. In addition, the density and the thermal conductivity of the frost vary unpredictably and through a wide range. It is clear that no mathematical solution to the problem is possible if all the numerous variables were considered.

In the present study the problem is idealized as follows: In Fig. 18, D_o is the diameter of the original cylinder. It is assumed that frost forms uniformly along the cylinder surface and that the conductivity of frost does not vary with time. Two major time variables are considered in the transient analysis, *viz*: (a) variation of air-frost interface temperature with time; and (b) variation of Reynolds number and heat and mass transfer coefficients with the growing frost layer.

Let t, represent the interface temperature and D the outer diameter of the frosted cylinder for any time, τ. Then if the heat storage within the frost layer and the superheat of the vapor transferred are neglected, the Equation 16 can be set up from the heat balance.

$$Q_\tau = \frac{2\pi K_f (t - t_w)}{\ln(D/D_o)} = h\pi D(t_o - t) + L\pi D h_m \rho (W_o - W) \quad \text{.....(16)}$$

Here, t and w are functions of time. Equation 16 can be transformed into:

$$\frac{2K_f}{K}\frac{(t - t_w)}{\ln(D/D_o)} = Nu(t_o - t) + Sh\left(\frac{Pr}{Sc}\right)\frac{L}{C_p}(W_o - W) \quad \text{.....(17)}$$

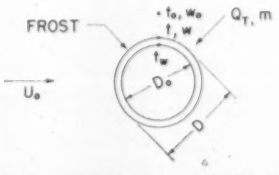


Fig. 18 — Diagram of original cylinder and quantities used in setting up heat balance

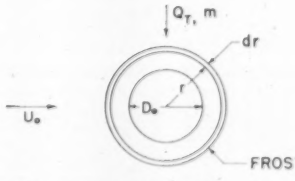


Fig. 19 — Diagram used in setting up mass balance

From the heat and mass transfer analogy, $Nu = C_1 (Sh)$.

$$\text{From Fig. 7, } Sh = C_2\left(\frac{U_o D}{\mu/\rho}\right)^n = C_2\left(\frac{U_o D_o}{\mu/\rho}\right)^n \left(\frac{D}{D_o}\right)^n$$

$$Nu = C_3 (Re)^n \left(\frac{D}{D_o}\right)^n,$$

$$\text{where } C_3 = C_1 C_2 \text{ and } Re = \left(\frac{U_o D_o}{\mu/\rho}\right)$$

Write: $W_o - W = (W_o - W_w) - (W - W_w)$, and $T_o - T = (T_o - T_w) - (T - T_w)$. Here, W_w and W represent the specific humidities of the saturated air at t_w and t, respectively. Since $(t - t_w)$ is usually small it can be assumed that $T - T_w = b\,(W - W_w)$ where b is a constant within the particular temperature range.

Finally, Equation 17 transforms into Equation 18.

$$\frac{W - W_w}{W_o - W_w} = \frac{C_3 \dfrac{t_o - t_w}{W_o - W_w} + C_2 \dfrac{Pr}{Sc}\dfrac{L}{C_o}}{2\dfrac{K_f}{K}\left(\dfrac{bRe^{-n}}{(D/D_o)^n \ln(D/D_o)}\right) + C_2\dfrac{Pr}{Sc}\dfrac{L}{C_o} + C_3 b} \quad \text{.....(18)}$$

For the mass transfer process, Fig. 19 is considered, and the mass balance of Equation 19 is made on the cylinder.

$$2\pi r \rho_f dr = h_m 2\pi r \rho (W_o - W)\, d\tau \quad \text{.....(19)}$$

This is changed to the following form.

$$\frac{d\left(\dfrac{D}{D_o}\right)}{d\left(\dfrac{U_o \tau}{D_o}\right)} = \frac{2C_2(W_o - W)}{Re^{1-n} Sc \left(\dfrac{\rho_f}{\rho}\right)\left(\dfrac{D}{D_o}\right)^{1-n}}$$

Writing $W_o - W = (W_o - W_w) - (W - W_w)$, the equation is transformed to the integral form shown in Equation 20.

$$\int_1^{D/D_o} f\left(\frac{D}{D_o}\right) d\left(\frac{D}{D_o}\right) = (W_o - W_w)\frac{U_o \tau}{D_o} \quad \text{.....(20)}$$

$$\text{where, } f\left(\frac{D}{D_o}\right) = \frac{Re^{1-n} Sc \left(\dfrac{\rho_f}{\rho}\right)\left(\dfrac{D}{D_o}\right)^{1-n}}{2C_2\left[1 - \dfrac{W - W_w}{W_o - W_w}\right]} \quad \text{.....(21)}$$

For a given value of $(t_o - t_w)/(W_o - W_w)$, Equation 18 gives the parameter $W - W_w/W_o - W_w$ as a function of the diameter ratio (D/D_o). Substitution of $W - W_w/W_o - W_w$ into Equation 20 gives the relationship between the parameters D/D_o and $U_o \tau/D_o$.

Finally the relation between $W - W_w/W_o - W_w$ and $U_o \tau/D_o$ is obtained, and the total heat transfer at any given time is evaluated from Equation 16. The total mass transferred up to any time, τ is obtained from the relation between D/D_o and $U_o \tau/D_o$.

In the foregoing analysis, the integral in Equation 20 must be evaluated numerically since the integrand

$f\ (D/D_o)$ is complicated. In some applications, however, the temperature difference $(t_o - t_w)$ is small. The integration of $f\ (D/D_o)$ becomes rather simple under such cases for the duration of time in which (D/D_o) is nearly equal to 1. For small values of $(t_o - t_w)$, $(t_o - t_w)/(W_o - W_w) = b \doteq t - t_w/W - W_w$ and Equation 18 simplifies to Equation 22.

$$\frac{W-W_w}{W_o-W_w}=\frac{\psi_o}{2\frac{K_f}{K}bRe^{-n}}{(D/D_o)^n ln(D/D_o)}+\psi_o \qquad (22)$$

where, $\psi_o=C_1b+C_2(Pr/Sc)\frac{L}{C_p}$

Now for the values of (D/D_o) close to one, $ln\ (D/D_o) \simeq (D/D_o) - 1$.

With this in mind, Equation 22 is substituted into Equation 21 and in turn Equation 21 is substituted into Equation 20. Equation 20 is then integrable, and its integration finally yields Equation 23.

$$(W_o-W_w)\frac{U_o\tau}{D_o}=\psi_1\left(\frac{\psi_o}{6}-\frac{\psi_2}{2-n}\right)+\psi_1\left[\frac{\psi_2}{2-n}\left(\frac{D}{D_o}\right)^{2-n}+\frac{\psi_o}{3}\left(\frac{D}{D_o}\right)^3-\frac{\psi_o}{2}\left(\frac{D}{D_o}\right)^2\right] \qquad (23)$$

where,

$$\psi_1=\frac{ScRe\left(\frac{\rho_f}{\rho}\right)}{4C_2b\left(\frac{K_f}{K}\right)}, \text{ and } \psi_2=2\left(\frac{K_f}{K}\right)bRe^{-n}$$

Diffusional Process Within Frost Layer and Variation of the Thermal Conductivity with Time

It is known that the properties of already-formed frost vary with time. The mode of variation depends on different parameters. It is thought that the variation of frost density and conductivity is largely due to the diffusion of vapor through the porous frost layer. It is also thought that the migration of vapor occurs mainly due to its concentration gradient which exists through the frost. This concentration gradient is created by the temperature gradient which usually exists in the frost layer.

Fig. 20 represents the enlarged cross section of a porous frost layer.

The air in the frost is saturated with water vapor at the local temperature of the frost. Therefore, a particular concentration gradient exists for the given temperature gradient through the frost.

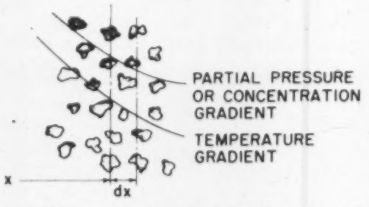


Fig. 20 — Representation of enlarged cross-section of a porous frost layer

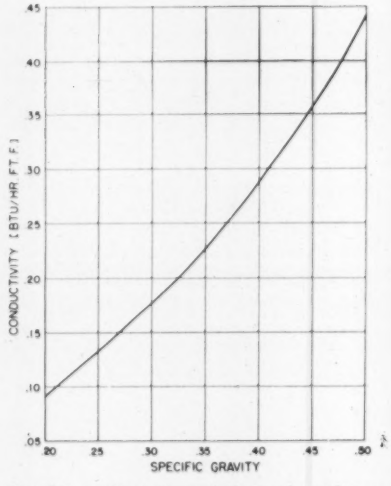


Fig. 21 — Variation of thermal conductivity of frost with specific gravity (obtained by Devaux, Reference 10)

Consider the vapor which is to be driven across the plane at x. The vapor cannot go through the solid portion but must go through the gaps between the solids. Therefore, the total free area available for the diffusion process is determined by the over-all density of the frost at the location. If there is no solid at all, the diffusion flux across x at any given time τ is represented by the equation $m_x = -\delta\ (\partial c/\partial x)$. On the other hand, let ρ_{fo} represent the density of the frost for which there is no free area available for the vapor migration. Then:

$$m_x = -\delta\ (1 - \rho_f/\rho_{fo})\ (\partial c/\partial x) \qquad (24)$$

where

$$\rho_f = \rho_f\ (x, \tau) \text{ and } C = C\ (x, \tau).$$

The total heat transfer at x for any given time τ is:

$$q_x = -K_f\ (\partial t/\partial x) - \delta L\ (1 - \rho_f/\rho_{fo})\ (\partial c/\partial x) \qquad (25)$$

Now, for the saturated air and for the small temperature differences imposed on the frost, the temperature t can be represented as a linear function of C, therefore, $t = a + bc$.

It is seen in Fig. 21 that K_f can be approximately represented by a linear function of ρ_f within a limited range, therefore, $K_f = i + K_o\ \rho_f$ where i and K_o are constants. The numerical value of i is very small, therefore, $K_f = K_o\ \rho_f$. With these approximations imposed on Equation 25,

$$q_x=-\left[K_obp_f+\delta L\left(1-\frac{\rho_f}{\rho_{fo}}\right)\right]\frac{\partial C}{\partial x} \qquad (26)$$

$$q_{(x+dx)}=q_x-\left[K_obp_f+\delta L\left(1-\frac{\rho_f}{\rho_{fo}}\right)\right]\frac{\partial^2 C}{\partial x^2}dx-\left[K_ob-\frac{\delta L}{\rho_{fo}}\right]\frac{\partial C}{\partial x}\frac{\partial \rho_f}{\partial x}dx,$$

and $q_x-q_{(x+dx)}=C_M\rho_f b\frac{\partial C}{\partial \tau}$

Finally,

$$\left(K_ob-\frac{\delta L}{\rho_o}\right)\rho_f\frac{\partial^2 C}{\partial x^2}+\delta L\frac{\partial^2 C}{\partial x^2}+\left(K_ob-\frac{\delta L}{\rho_w}\right)\left(\frac{\partial C}{\partial x}\right)\left(\frac{\partial \rho_f}{\partial x}\right)=C_M\rho_f b\frac{\partial C}{\partial \tau} \qquad (27)$$

Similarly, from Equation 24, the transient diffusion Equation 28 is derived.

$$\frac{\partial^2 C}{\partial x^2}-\frac{\rho_f}{\rho_{fo}}\frac{\partial^2 C}{\partial x^2}-\frac{1}{\rho_{fo}}\frac{\partial C}{\partial x}\frac{\partial \rho_f}{\partial x}=\frac{1}{\delta}\frac{\partial \rho_f}{\partial \tau} \qquad (28)$$

Simultaneous solution of Equations 27 and 28 with proper boundary conditions yields $\rho_f\ (x, \tau)$ and

whence $K_f = K_f(\rho_f) = K_f(x, \tau)$. Equations 27 and 28 are applicable to a frost layer formed on a flat plate.

A similar method was applied to a layer of frost formed on a circular

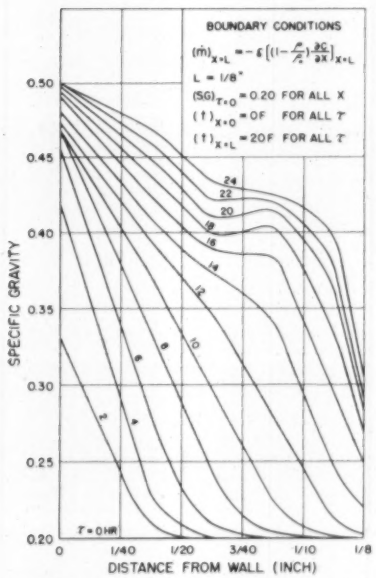


Fig. 22 — Variation of specific gravity with time

cylinder and Equations 29 and 30 were derived:

$$\left(K_o b-\frac{\delta L}{\rho_{fo}}\right)\rho_f\frac{\partial^2 C}{\partial r^2}+\delta L\frac{\partial^2 C}{\partial r^2}+\left(K_o b-\frac{\delta L}{\rho_{fo}}\right)\frac{\partial C}{\partial r}\frac{\partial \rho_f}{\partial r}+\left(K_o b-\frac{\delta L}{\rho_{fo}}\right)\frac{\rho_f}{r}\frac{\partial C}{\partial r}+\delta L\frac{1}{r}\frac{\partial C}{\partial r}=C_{pf}\rho_f b\frac{\partial C}{\partial \tau} \quad \text{(29)}$$

and,

$$\left(1-\frac{\rho_f}{\rho_{fo}}\right)\frac{\partial^2 C}{\partial r^2}-\frac{1}{\rho_{fo}}\frac{\partial \rho_f}{\partial r}\frac{\partial C}{\partial r}+\left(1-\frac{\rho_f}{\rho_{fo}}\right)\frac{1}{r}\frac{\partial C}{\partial r}=\frac{1}{\delta}\frac{\partial \rho_f}{\partial \tau} \quad \text{(30)}$$

Both sets of the Equations 27 and 28, 29 and 30 are complicated, and could not be solved analytically. However, with some simplifications derived from the physical conditions, Equations 27 and 28 are solved here numerically.

The second term on the right hand side in Equation 26 represents the heat transfer due to the latent heat of the vapor migrated. In a thin frost layer, the vapor migration is a slow process. The heat transfer, then associated with the vapor migration is of small magnitude compared to the heat transfer by conduction. Therefore this particular term in Equation 26 is neglected. Also, the heat stored in the frost can be neglected since usually the frost layer considered is thin. Under these assumptions, Equation 27 is simplified to:

$$K_o b\rho_f\frac{\partial^2 C}{\partial x^2}+K_o b\frac{\partial C}{\partial x}\frac{\partial \rho_f}{\partial x}=0 \quad \text{(31)}$$

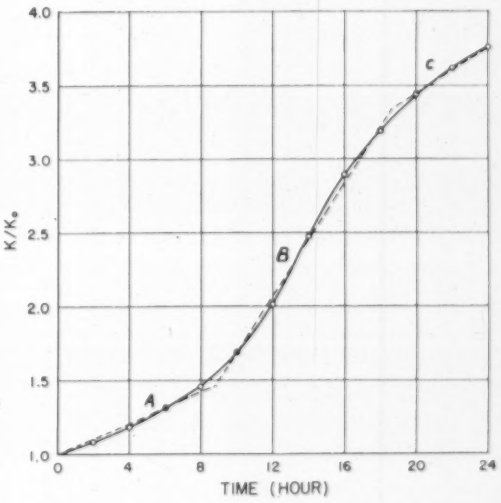


Fig. 23 — Variation of overall conductivity with time

Equations 28 and 31 can be solved numerically by changing them to a set of finite difference Equations.

Numerical Evaluation of the Equations

Equations 13 and 14 applied to the bare cylinder were solved for the boundary conditions at which the experiments were conducted in Part I. The total heat transfers calculated along the laminar region of the cylinder surface were then compared to the corresponding test data. A typical comparison is shown in Fig. 24. The steady state overall heat transfer for the entire cylinder was discussed in Part I.

The finite difference equations corresponding to the diffusion Equations 28 and 31 are solved numerically for the diffusion through a frost layer for the following boundary conditions:

For all τ: $m_x = 0$, at $x = 0$; $m_x = -\delta(1-\rho_f/\rho_{fo})\,\Delta C/\Delta x$, at $x = L$; $t_x = 0$ F, at $x = 0$; $t_x = 20$ F, at $x = L$.
For all x: S. G. = 0.2, for $\tau = 0$, $L = 1/8$ in.

Figs. 22 and 23 show the results of the calculations.

In Fig. 23 the conductivity variation curve of the frost is subdivided into 3 different periods. There is the first period (A in Fig. 23) during which variation of conductivity is small. Then a rapid increase is observed in the following period (B in Fig. 23). Finally, the conductivity approaches a limiting value during the period C. A similar pattern is also observed in one of the experiments found in Reference 1 (Part

1). The absolute length of the periods and magnitude of the increases will depend on the particular boundary conditions. However, it is thought that the diffusion process of vapor through the frost will result, in general, in the mode of variation shown. The quasi-steady state in heat transfer found in Part I is then reached mainly as the period of the rapid increase in the conductivity (period B) begins.

One may logically assume from the preceding analysis that the conductivity of the frost is not appreciably influenced by diffusion of the vapor through the frost during the first 60 to 80 min of transient heat transfer period (Part I). Then, the time dependency of the density and conductivity of the frost during this period may be neglected. It is known, however, that the frost formed under different conditions has different properties.

Here the Equations 16, 18 and 20 are solved in conjunction with the experimental results so that the average density and conductivity of the frost formed under the different conditions during the transient period could be obtained.

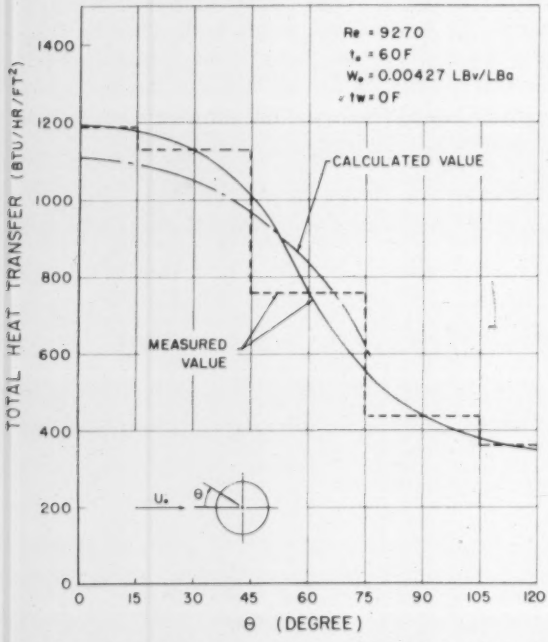


Fig. 24 — Comparison of measured and calculated values of total heat transfer rate along the laminar boundary layer

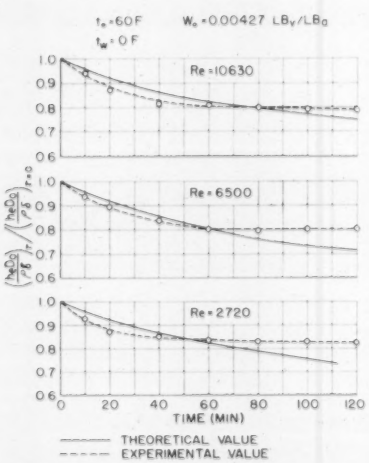


Fig 26 — Comparison of theoretical values and experimental values of total heat transfer variation

Values of the densities and the conductivities were chosen from Fig. 21 for given tested conditions. Equations 16, 18 and 20 were then solved, and the heat transfer variation was obtained. The calculated result for the first 60 to 80 min was compared to the corresponding experimental result. The solution and the comparison with the test result were continued until a good correlation was obtained. These trial-and-error type calculations were performed for 3 Reynolds Numbers and $t_o - t_w/W_o - W_w$, the same conditions at which some of the experiments were conducted in Part I. After much study, it was decided to plot the average frost densities thus obtained for the first 60 to 80 min as a function of the total heat transfer potential, h_e

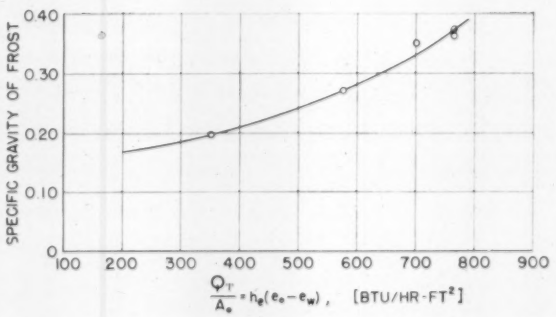


Fig. 25 — Variation of specific gravity of frost vs total heat transfer flux deduced from the experimental and theoretical studies

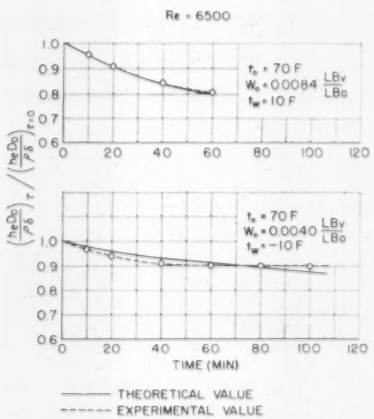


Fig. 27 — Comparison of theoretical values and experimental values of total heat transfer variation (Re = 6500)

$(e_o - e_w)$ (see Part I). Fig. 25 shows this result. Figs. 26 and 27 show the correlations between the calculated and tested values of the total heat transfer variation. Fig. 28 shows similar correlations for mass transfer.

It is seen in Figs. 26, 27, and 28 that Equations 16, 18 and 20 approximate the variations of heat and mass

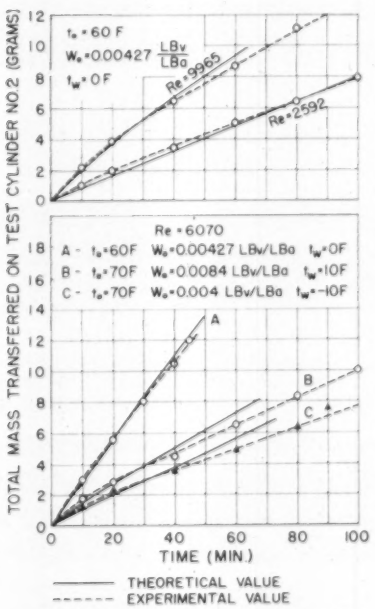

TOTAL MASS TRANSFERRED ON TEST CYLINDER NO.2 (GRAMS)
t_o = 60 F
W_o = 0.00427 LBv/LBa
t_w = 0 F
Re = 9965
Re = 2592
Re = 6070
A - t_o = 60F W_o = 0.00427 LBv/LBa t_w = 0F
B - t_o = 70F W_o = 0.0084 LBv/LBa t_w = 10F
C - t_o = 70F W_o = 0.004 LBv/LBa t_w = -10F
A
B
C
TIME (MIN.)
THEORETICAL VALUE
EXPERIMENTAL VALUE

Fig. 28 — Comparison of theoretical values and experimental values of mass transfer

transfers well when they are solved with the aid of Fig. 25. Therefore, the equations may be used with Fig. 25 to calculate the heat and mass transfers for the first 60- to 80-min transient periods for different combinations of Re, $t_o - t_w/W_o - W_w$, and h_e $(e_o - e_w)$. After the first 60- to 80-min period, the process becomes quasi-steady. This condition was discussed in Part I.

The experiment in Part I was conducted essentially with one diameter cylinder. Therefore nothing can be said with certainty for different diameter cylinders. However, it is reasonable to assume, from the derivations of the equations used and the close correlations found between the calculated and experimental values, that the preceding analyses would be applicable to any other diameter cylinders. The variations of heat and mass transfer are calculated by the Equations 16, 18, and 20 and Fig. 25 for a ½-in OD tube with U_o = 510 fpm, t_w = 0 F, t_o = 15 F, and 97 percent relative humidity of the air stream. The result appears in Fig. 29.

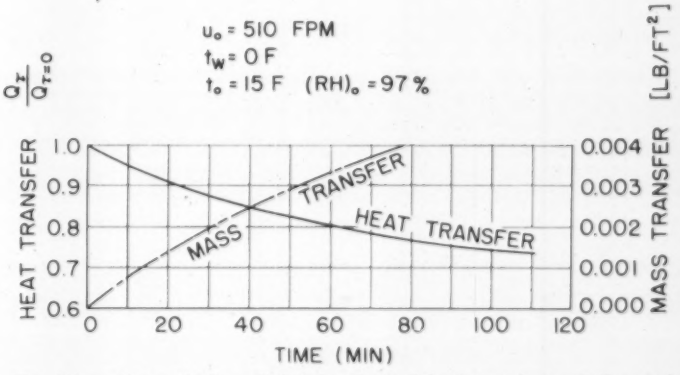


Fig. 29 — Theoretically calculated values of heat transfer variation and mass transfer for a ½ in. OD tube

Conclusions

The ratio of Stanton number of mass transfer to that of heat transfer was found from the experiment to be 0.88. This agreed closely with the ratio of 0.90 obtained for a flat plate in Reference 11. The Stanton number ratio was 1.036 when it was calculated by Colburn's analogy between heat and mass transfer.

The theoretically developed Equation 13 for steady state heat transfer along the laminar boundary layer on the cylinder enables one to calculate the local heat transfer with the possible error of 10 percent, and the overall heat transfer from $\theta = 0$ deg to $\theta = 70$ deg with the possible error of 6 percent.

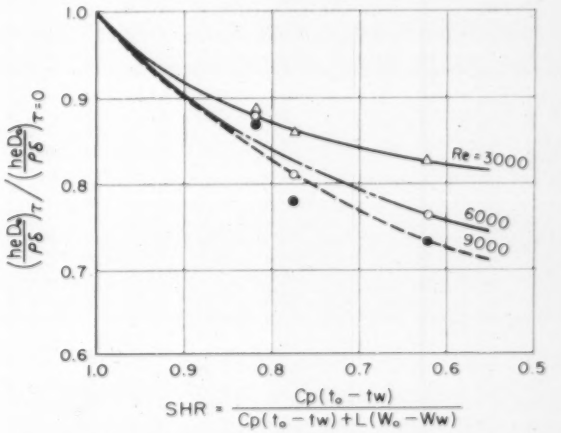


Fig. 30 — Total heat transfer rate after equilibrium is established (time >80 min) vs sensible heat ratio

Typical variations of local heat transfers with time are shown on Figs. 10 and 15.

The test results showed that a quasi-steady state in total heat transfer was reached in 60 to 80 min for the cases tested (Figs. 11, and 12). A similar phenomenon was also observed in Reference 14, (Fig. 1) for a flat plate.

Fig. 30 plotted from Figs. 7 and 16 shows that the decrease in the heat transfer to the quasi-steady state is largely influenced by the Reynolds number and the sensible heat ratio for a given diameter of a cylinder. The decrease becomes greater as the sensible heat ratio decreases and as the Reynolds number increases. The theoretically developed Equations 16, 18 and 20 also bear out similar facts. The equations also show that the parameter $U_o\tau/D_o$ plays an important role when different size cylinders are considered.

Solution of Equations 16, 18, 20, 28 and 31 in conjunction with the present experimental results showed that Equations 16, 18 and 20 may be used with Fig. 25, to predict the transient heat and mass transfer processes until the quasi-steady state is reached.

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WATER—A RAW MATERIAL OF INDUSTRY

As a feature of its annual meeting *ASTM* has set up the Edgar Marburg Lecture. The 31st of these lectures was given at the 1957 Annual Meeting by E. P. Partridge, whose work in connection with water problems has extended over a period of 30 years. Mr. Partridge's lecture is printed in full in a booklet published by *ASTM* under the title *Your Most Important Raw Material.*

While the lecture as a whole covered various aspects of the subject of water as a raw material some sections of it are of especial interest to air-conditioning engineers.

It is indicated that the actual consumption of water in all uses during 1955 has been estimated as being 86.5 billion gallons per day. While this is a sizeable figure in itself it should be kept in mind that the average daily run-off is 1164 billion gallons. The problem for the immediate future therefore can scarcely be said to result from the lack of water in total. However, there is the problem of the water not always being available where it is most needed. For example, there is an excess of water now in the rain forests along the northwest coast and so also was there an excess in the streets of Dallas last spring. Mr. Partridge feels that the real problem is that soon water will no longer be virtually free and more human effort will be needed to store and transport it and to reuse it.

Concerning the subject of obtaining fresh water supplies from sea water it is indicated that while there is much interest in the subject, actual progress in the way of installations is rather slow. Mention is made of a plant now operating in Kuwait on the Persian Gulf which makes use of a recently developed method by Hickman. It is stated that an overall heat transfer coefficient of at least 2200 Btu per (hr) (sq ft) (F deg) has been maintained for 200-hr runs at 125 and 150 F with no apparent scale formation. However at 180 F a calcium carbonate scale formed rapidly. The unit is expected to require about 42 kwhr per 1000 gal of pure water produced. The operating unit was designed for a 25 thousand gallon daily capacity.

Mr. Partridge turned attention to the prospects of obtaining pure water from sea water by the use of freezing, and pointed out that a great deal of development work is still needed before it will be known whether reasonably low costs can be obtained.

It is estimated that perhaps 85 percent of the water withdrawn by industry is made use of for cooling purposes. However little of this water is actually consumed as most of it is returned to its source after having been used. As to the use of recirculated water for cooling purposes the only water which is actually consumed is that which is lost from the system by evaporation and windage or which is deliberately blown down to keep dissolved solids at desirable levels. The cooling tower is looked upon as an air washer which collects airborne dirt, gases and organisms. It keeps itself systematically seeded with algae, bacteria and fungi. The author states that if the cooling tower were human it would certainly be in danger of contracting hay fever.

CONFERENCE ON SOUND AND VIBRATION SUGGESTED

At a meeting of a subcommittee of the TAC on Sound and Vibration, held at the ASHAE Research Laboratory, Cleveland, on July 22, it was voted to recommend that an all-industry conference be held in conjunction with the 1960 Annual Meeting of the Society. It was also recommended that the Conference be directed toward noise problems in air conditioning and that the conference consist of nontechnical discussions and a demonstration with the possibility of having technical papers on sound presented at a technical session.

Air Condensers with Gravity Flow

By

R. C. Edwards

The author is president, Edwards Engineering Corp., Pompton Plains, N. J. A presentation at the Symposium on Condensing Methods at the Semi-Annual Meeting of the AMERICAN SOCIETY OF HEATING AND AIR-CONDITIONING ENGINEERS, Minneapolis, Minn., June 25, 1958.

THREE years ago the writer attended a meeting of *ASRE* in Milwaukee where a forum was held on gravity air-cooled condensers. The forum moderator asked if anyone was familiar with the performance of these condensers. Since, over a period of 8 or 10 years, the writer had personally developed some formulae that partially explained the performance of convection elements,

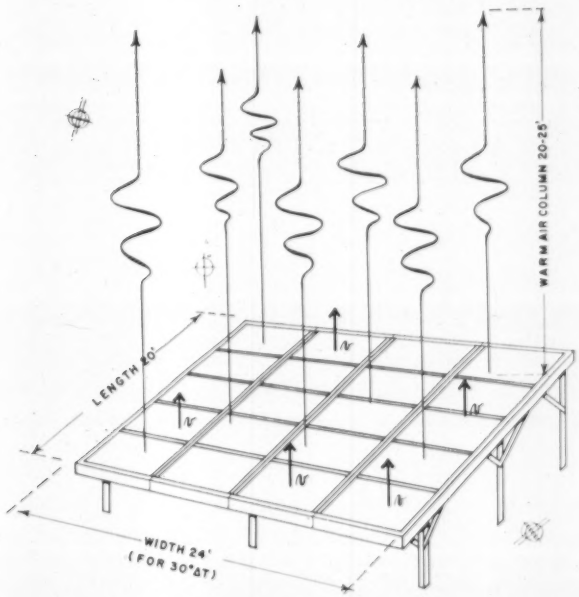

Fig. 1 — Diagram of a gravity flow convection type air-cooled condenser

he mentioned to the moderator that he would put one on the blackboard. While a discussion of the equation was proceeding someone made a remark which induced the writer to become interested in wire condensers and convection air flow over these condenser surfaces. On the airplane back to New York some work was done on the mathematics involved on convection surface, and the following was determined. If one were to imagine a horizontal surface of 1 sq ft area and assumed that at the level of the surface there was an invisible grid which would, without friction, suddenly change the temperature of the air as the air entered the grid, it would be possible to calculate the heat flow through the grid as a function of the column height and the temperature difference between the column and the ambient air. A calculation of the heat flux through the imaginary grid showed that approximately 7000 Btu per (hr) (sq ft) could be rejected for a grid area of one sq ft with a 6-ft column height and a temperature difference of 30 deg between the column air and the ambient air. It was evident that the basic problem presented was, therefore, to develop a surface that would give the highest heat transfer with the lowest resistance to air flow. The 7000 Btu per hr represents almost ½ ton and looked very interesting.

To solve the problem, a study was first made with grids constructed of wires and tubes. However, after very extensive testing, plate fins and tubes appeared to give the most economical results. Therefore, from a commercial standpoint it was decided to proceed with plate fins and tubes.

Theory of the Condenser

Fig. 1 schematically illustrates a convection condenser. From this illustration one can visualize that the larger the condenser the greater the height of the convection column. That is one of the particular features of the convection condenser. With a small condenser a particular output per square foot of face area will be obtained, but due to the increase in the stack height of the convection column the output of the condenser per square foot of face area increases as the condenser becomes larger. Equation 1 theoretically describes the performance of the condenser, and from this equation the increase in output per square foot of face area can be approximated.

$$\text{Heat rejected} = f(Ah^{1/2}\ \Delta t^{1.5}) \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (1)$$

where

A = area of the convection column, square feet.
h = height of the convection column, feet.
Δt = difference in temperature between the air in the column and the ambient air, Fahrenheit degrees.

The equation indicates that the heat rejection to the air (*i.e.*, the condenser capacity) is a function of area, of stack height to the ½ power, and of the difference in temperature to the 1½ power. The effect of temperature change, or Δt, is extremely important. This effect means that if the working temperature difference is 25 deg and,

due to some inadvertent loading of the condenser the temperature difference increases to 30 deg the heat rejected, or capacity, goes up 30 percent. Contrast this with the 20 percent increase which takes place with the usual type of fan-and-coil condenser where the capacity varies as the temperature difference to the one power. This means that with a gravity convection condenser there is a built-in overload protection. This is a highly important fact and opens up possibilities for the use of gravity convection condensers with centrifugal compressors, since the centrifugal compressors are extremely critical to overloading or high head pressure.

The equation also points up the fact that the heat rejection is related to the height of the convection column to the ½ power, ($h^{0.5}$). The greater the condenser face area

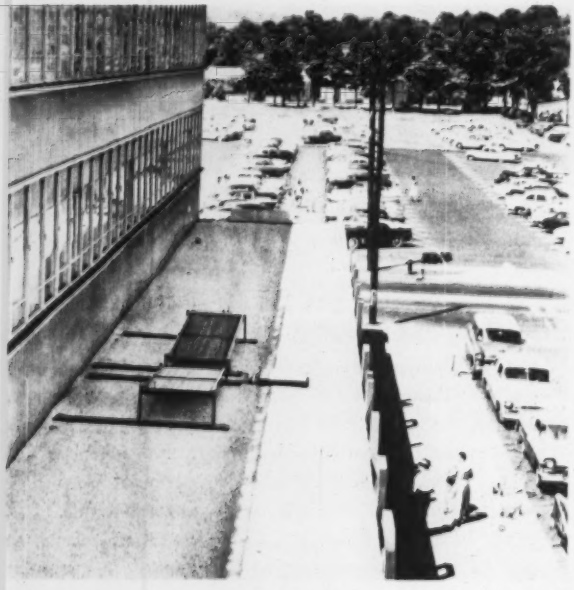

Fig. 2 — A 5-ton capacity condenser on the roof of a chain store in New Jersey

becomes, the greater is the height of the effective convection column of warm air rising from the condenser face.

Tests made in the laboratory indicate that for a flat condenser grid, the effective height, h, is approximately equal to the square root of the face area of the condenser.

In that event, for flat gravity convection condensers, Equation 1 becomes

$$\text{Heat rejected} = f(A^{1.25}\ \Delta t^{1.5}) \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (2)$$

The meaning of this equation is of considerable interest. Simply stated, the equation indicates that if a given convection condenser is rated at 1 ton and if 16 such units are put together, the heat rejection capacity is not 16 tons, but is 32 tons. Similarly if 81 such units were put together the capacity would not be 81 tons, but 243 tons. In summary, the heat rejected per square foot of condenser face area increases with condenser size. The increase is at the rate of the fourth root of the size.

The foregoing is a history of the idea and an outline of the theory on which the condenser operates. Let us now

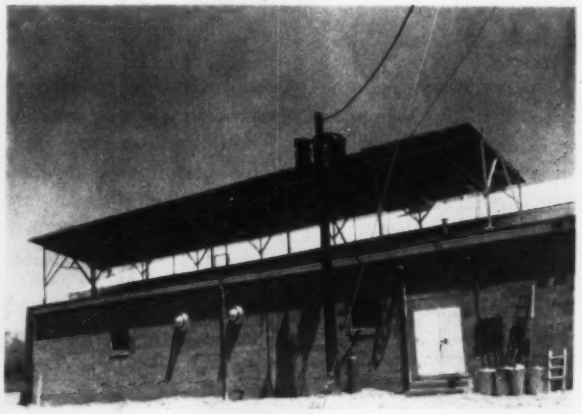

Fig. 3 — View of a 90-ton capacity installation above the roof of a bowling alley

turn attention to some of the installations which have been made and some of the results.

Installations and Results

Fig. 2 shows one of the early installations of the gravity convection condenser. The illustration shows a 5-ton capacity condenser using R-12. It can be clearly seen that the surface used is finned tubing and that the condenser is pitched downward. The R-12 is pumped into the elevated side and picked off the lower side. There are no fans.

Fig. 3 is a 90-ton installation on a bowling alley roof. The condenser was designed for a 25 deg temperature difference but average operating difference has been found by measurement to be approximately 20 to 22 deg. The design is based on still air conditions. However, when the wind blows there is a considerable improvement in heat transfer. The velocity of the air up through the condenser surface generated by the gravity effect alone is about ½ mph. Whenever the wind blows at a velocity of more than about ½ mph there is an increase in capacity of the condenser unit. If the operating temperature difference under substantially still air conditions is 25 deg, a 10 mph wind will reduce the difference to approximately 17 deg.

Data concerning wind velocity and the time of day when the wind velocity is greatest and least are of interest. In Minneapolis for July 1954, for example, the Weather Bureau data shows that during only 9 percent of the time was the wind velocity less than 3 mph, and during 64 percent of the time the velocity was more than 8 mph.

Whenever the wind is blowing the user of a gravity convection condenser is saving electrical energy required to operate his air-conditioning system because the operating head pressure has been lowered by the wind. So seldom does the wind velocity drop to ½ mph that rarely does the convection condenser actually work under design conditions.

Fig. 4 — In the far corner is a 10-ton capacity condenser on the roof of a chain grocery store in Florida

The Weather Bureau data in Minneapolis shows that the daily high temperatures usually occur around 2:00 p.m. and that the minimum wind velocities rarely ever occur at this time. Minimum wind velocities usually occur in early evening or early morning. Thus wind acts as a safety device during times of maximum outside temperature.

In the installation shown in Fig. 3, the condenser was carefully bolted to the roof to prevent wind damage. The convection condenser necessary for the air-conditioning systems cooling the entire one-story building has a face area of 1000 sq ft. The total area of the building is 30,000 sq ft. Thus the condenser uses about 3 percent of the roof area.

Effect of Sun and Tilting

The effect of sun on the condenser's performance is of interest. However, due to the more pronounced effect of the wind, the effect is fairly difficult to determine. Fairly extensive data obtained by the writer indicate that the sun, if directly shining upon the condenser, increases the split about 10 percent if the split is of the order of 25 F. The writer once had the idea of putting blackened louvres over the condenser with the thought of using the sun heat to help in the convection effect. However, in placing such a blackened grid on top of the condenser no appreciable change in output could be observed. Probably the increase in convection effect was offset by the increase in resistance to air flow offered by the louvres.

Another point of considerable interest in connection with the output of the condenser is the effect of tilting the condenser. In effect the concern is with the output of the condenser as a function of the angle of mounting with respect to the horizontal. It is imperative that the condenser be pitched at least 5 deg to keep the condenser drained of liquid refrigerant, otherwise the capacity would be reduced. If the wind is permitted to easily strike the condenser it was found that a vertical condenser performed just as well as one mounted horizontally. Inside a building the condenser can be tilted to about a 25- or 30-deg angle before the capacity is greatly affected. Last summer a 5-ton condenser was operated on the roof of a building with the coils standing completely vertical, and was found to function satisfactorily throughout the summer. As a matter of fact, it appeared to work better than a condenser pitched 7 deg with the horizontal. However, the condenser stood unobstructed on a large open roof.

Fig. 5 — Close-up view of the same 10-ton installation of Fig. 4

Mounting

In regard to the mounting of the convection condenser on the roof, it appears that the condenser should be set high enough above the roof surface so that the area between the edge of the condenser and the roof is about the same as the face area of the condenser. Since the con-

denser weighs from 3 to 4 lb per sq ft (or no more than 3½ to 4½ lb, if flooded) it can be supported on most existing structures without additional structural support. However, ample provision should be made for snow load on the condenser legs.

First Costs and Maintenance and Operating Cost

The amount of tubing required to fabricate a convection aircooled condenser is about the same as for any fan-and-coil condenser. However, about 50 percent more fin surface is required. Since no motors and fans are needed, their cost about balances the cost of the additional fin stock. This situation permits the gravity condenser to reach the market at about the same price as the power-driven type in the small capacities — say from 3 to 10 tons. As the capacities increase up to 50 or 100 tons, and higher, the indications are that the first cost of installation should be less than for power-driven types.

As regards maintenance and operating costs, the following comments can be made. Since the fins are widely spaced, the rain will keep them clean. The experience has been very good with maintenance. At the most the brackets and supports should be painted at 4- or 5-year intervals. Since there is no fan motor and thus no electrical consumption, the saving in electrical energy for the fan motor, coupled with the saving in electrical energy at the compressor due to the lower head pressure resulting from the wind, there is an overall saving in electrical power consumption over fan-and-coil condensers of from 18 to 25 percent.

Control

Head pressures can be very simply and readily controlled by merely back flooding 90 percent of the condenser. The remaining 10 percent of the condenser surface can be used on a straight through basis. A simple adjustable self-contained spring and bellows operated control is sufficient to maintain head pressure.

Fig. 4 shows a gravity condenser on the roof of a Florida chain grocery store. The condenser can be seen in the far corner. Fig. 5 is a close-up view of this same installation, and the condenser is of 10 tons rated capacity. This condenser operates without head pressure control.

Sides and Stacks

The possibility of putting sides or stacks on these convection condensers has also been investigated. With a small condenser up to 5 tons it has been found that adding a 7-ft stack approximately doubles the capacity. As the condenser becomes larger the condenser automatically creates its own stack. The writer is of the opinion that in view of the important effects of the wind on the condenser capacity, and also the importance of a low silhouette on the roof that it is preferable to install more horizontal condenser surfaces. The increase in horizontal condenser surface will automatically increase the stack height without the use of a built-up chimney stack. However, in tight locations the use of a stack or built-up sides can definitely be used to increase the condensing capacity.

In summary, the large gravity or convection condenser appears to have a place in our installations.

ENGINEERING SECTION, *AAAS*, WASHINGTON MEETING IN DECEMBER

National and International Aspects of Systems of Units in Coordinated Disciplines of Science and Technology, will be the theme for the Section M—Engineering program of the 125th Annual Meeting of the *American Association for the Advancement of Science*, in Washington, D. C. December 26-31, 1958. Carl F. Kayan, New York, N. Y. ASHAE member, is chairman of the section.

Primary purpose of the program will be to focus attention on the growing international problems created by widespread use of different systems of units, and their relations to the U.S. system and operations. Authorities will present viewpoints from home and abroad on the unit systems and practices, including problems of standardization and the decimalization within the English systems.

Programs are available from the Secretary Section M (Engineering), *AAAS, Engineers Joint Council*, 29 West 39th St., New York 18, N. Y.

ATMOSPHERIC SCIENCE STUDY

As a result of a recommendation by the Committee on Meteorology of the National Academy of Sciences, it has been announced that the National Science Foundation has established a program for atmospheric science. Dr. Earl G. Groessler has been designated to direct the program.

RESEARCH EXECUTIVE COMMITTEE

Meeting in Evanston, Ill., on August 22, the Research Executive Committee took action to revise the scope of the TAC on Sorption and to continue cooperative work on Thermal Circuits at the University of California at Los Angeles.

The committee also heard reports concerning the progress of Laboratory activities. Work on the projects in the new Environment Room is under way. The noise program is largely concerned with noise generation and attenuation in elbows. Work is also in process on the redesign and rebuilding of plates for the human calorimeter for the Navy. Tests are being run on the experimental apparatus built for the measurement of steam and condensate flow in pipes. Currently the solar shading studies are continuing with draperies, curtains and between-glass shading. The odor program is completed for the present.

The committee also considered the budget for research for 1959, various TAC suggestions for future research projects, requests for activation of projects, future Laboratory plans, and insurance on the present Laboratory property.

1958 GRADUATE ENGINEERS PLACEMENT SURVEY

A survey of 1958 engineering graduates indicates that 83.5 percent of estimated 33,000 graduates of 1958 were hired a month before graduation. Despite unfavorable economic conditions in the U.S., only 10 percent of graduate engineers had no definite plans by late May and, as of June, none were without job offers. In spite of conditions, placement opportunities for new engineers are remarkably stable. Full report is available from *EJC*.

Low Frequency Combustion Noise in Oil-Burning Equipment

By G. J. Sanders* and W. E. Lawrie**, Chicago, Ill.

SUMMARY—Nature and causes of low frequency rumble from combustion are described. Fluctuations in the burning rate trigger both pulsation and rumble. Sources of combustion noise are stated and methods are suggested for reducing low frequency turbulences. Effects of fire box, flues and the room on rumble and pulsation are described. Considerations for reducing pulsation are presented.

AN EXTENSIVE investigation concerning low frequency combustion noises in oil-burning equipment has recently been completed for a large manufacturer of domestic heating equipment which resulted in a considerable amount of information concerning the cause of this noise. This paper has been written to make available that information which should be of value to the entire heating industry. Most work done during this program was on commercially available domestic oil fired heating units with a fuel consumption rate of between 0.85 and 2 gal per hr. A large portion was at a rate of 1¼ gal per hr. Fig. 1 shows the furnace installations on which most of the experimental tests were made. Draft was provided by a large exhaust fan on the roof of the building with the airflow and static pressure in the draft system being controlled by a by-pass valve. This enabled a relatively constant draft to be maintained so that more accurate measurements could be made.

To present a concise description of the mechanisms and controls for low frequency combustion noise, this paper is prepared as a short analysis of the entire combustion system with the various facts concerning the mechanism and control of furnace noise being documented by experimental evidence where necessary. Much experimental documentation has been omitted to avoid excessive length.

The noise discussed here is the low frequency rumble present to some degree in all oil-burner installations and which makes itself objectionable by shaking doors, walls, and floors. This noise is usually audible in the basement or utility room and often in the living space. This combustion noise has a frequency of between 30 and 55 cps. The character of this noise is not that of a continuous tone; rather, it is more like a 40 cycle tone interrupted at random times in such a manner that the tone is heard approximately 30 percent of the lapsed time. It was not the primary purpose of this program to work on the more severe noise commonly called pulsation. However, during the program the mechanism of pulsation was defined as a result of data obtained during the studies of rumble.

Fig. 1 — Combustion noise research installation

The Mechanism of Rumble

Noise called rumble which is composed of 4 or 5 cycle bursts of a frequency near 40 cps is caused by pressure pulses in the fire box cavity exciting the fire box and flue system resonances. The pressure pulses which are due to rough burning produce an impulse type of sound which contains many frequencies. The burning noise itself is similar in nature to the noise produced by a random noise generator. In other words, there is no distinct single frequency characteristic to this noise; rather it contains almost all frequencies, at varying amplitudes, at varying times.

The fire box cavity and flue passages along with the oil burner itself make up a system analogous to a

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For presentation at the 65th Annual Meeting of the AMERICAN SOCIETY OF HEATING AND AIR-CONDITIONING ENGINEERS, Philadelphia, Pa., January 1959.

Helmholtz resonator. A system such as this has a single resonant frequency excited by the random pressure pulses caused by rough burning (see Fig. 2).

Pulsation

Pulsation is a noise similar to but not the same as rumble. It has the same exciting source, namely rough burning, and the same resonant system with one exception. In pulsation

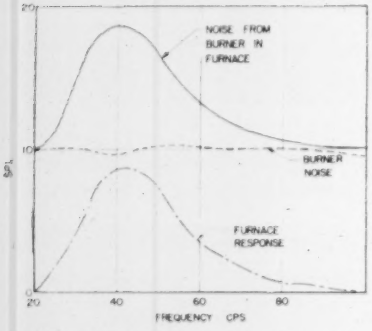


Fig. 2 — Amplification of low frequency combustion noise

the fan and fan housing are involved to a greater degree than in rumble.

Pulsation takes place in the following manner. Random pressure pulses in the fire box increase the instantaneous fire box pressure so that it is higher than the pressure in the blower housing (see Fig. 3). This momentary increase in pressure stops and then reverses the flow of air entering the fire box from the burner air tube. This causes a mixture of fuel and air too rich for combustion to be maintained in the fire box. After a short period of time the pressure in the fire box is reduced by the escape of gases through the flue passages. As soon as the pressure in the fire box is reduced below the pressure in the fan housing, air rushes in and mixes with the unburned fuel. This causes a second pressure increase which again stops the incoming air and causes the phenomenon to repeat itself until the conditions which produced pulsation have been eliminated. Pulsation frequency is determined by the decay rate of the pressure in the fire box which is determined by the resistance in the flue passages, the delivery characteristics of the blower, and the burning rate of the fuel.

The Noise Source

Both pulsation and rumble are triggered by random fluctuation in the burning rate of the fuel fire and the air mixture. These fluctuations are caused by turbulent conditions in the air supply and mixing systems. In this system, the fan, fan housing, and

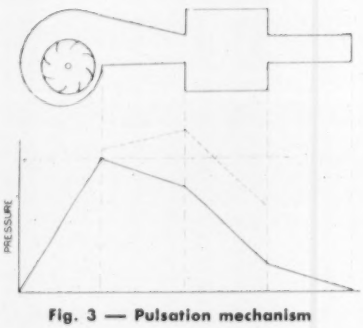


Fig. 3 — Pulsation mechanism

drawer assembly each contribute to the turbulent air entering the fire box. The choke shape is also an important contributor to the turbulence.

The turbulence referred to here and hereafter is that which is undesirable from a rumble and pulsation standpoint. Turbulences containing large fluctuations at a low repetition rate (between 0 and 100 cps) are objectionable because they can easily excite the fire box cavity resonance which is between 20 and 60 cps. Since turbulence is required for good mixing it should be of a high frequency and small amplitude to reduce the excitation of boiler resonance.

Turbulence Due to Fan Design: It is well known that fans with forward-curved blades, such as those used in standard oil burners produce a considerable amount of turbulence due to the swirl component given to the air as it leaves the fan blade, as shown in Fig. 4. This turbulence is in the frequency range of furnace cavity resonances, thus helping to produce random fluctuations in combustion in that range. These fluctuations in airflow could be smoothed out by using straightening vanes in the burner tube; however, this is not normally done in oil burner design. As a result, this turbulence propagates all the way to the mixing region and helps produce the exciting force for rumble and pulsation.

Turbulence Caused by Housing Shape: The fan housing normally used in oil burners is not streamlined to reduce the creation of turbulence. Sharp changes in cross-section cause eddies in the air stream, as shown in

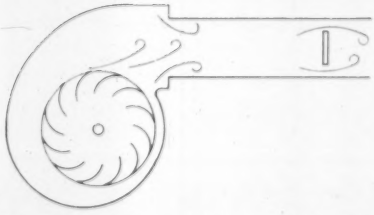


Fig. 4 — Fan and housing shape turbulence

Fig. 4. These eddies are propagated through the burner tube and into the region of fuel and air mixing. This also produces part of the exciting force which causes rough burning and helps create rumble and pulsation.

Turbulence Produced by Drawer Assembly Shape: The drawer assembly of most modern oil burners is not designed to maintain a smooth continuous air stream. Some burners change the characteristics of the airflow by inserting flat plate baffles. These baffles and other unstreamlined obstructions in the air passage cause

turbulence which adds to noise level (see Fig. 4).

Fuel and Air Mixing: Fuel and air are mixed together in a manner determined by their patterns upon entering the combustion chamber from the burner tube. If either the fuel or air enters the mixing zone in an irregular or turbulent manner the mixing will be turbulent and uneven and the burning will have the same characteristics. Most modern oil burners direct the air toward the fuel spray by a choke which rapidly reduces the cross-sectional area of the burner tube. This reduction in area is sudden and produces large scale turbulence at the beginning of the mixing zone.

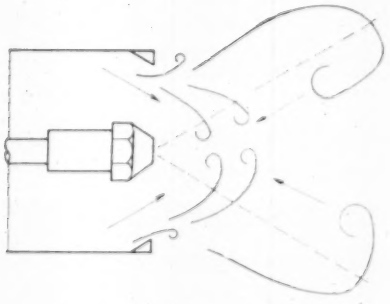
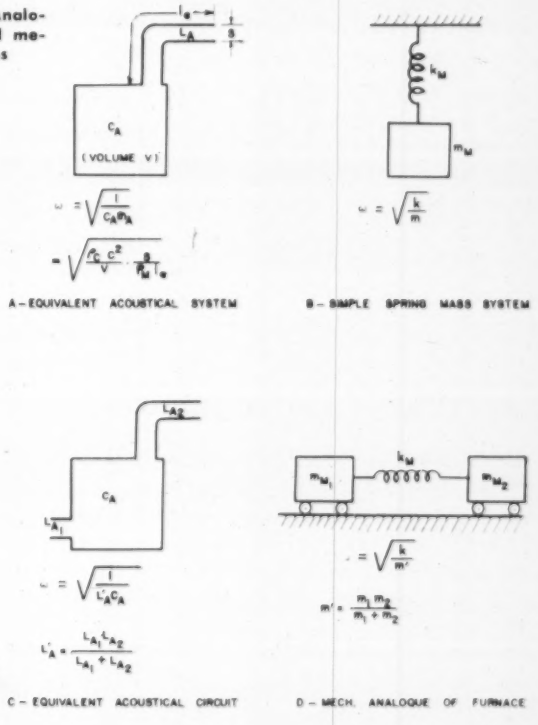


Fig. 5 — Mixing turbulence

One of the major mixing problems in oil burner design is the configuration of the fuel pattern emanating from the nozzle. This fuel pattern can vary from a hollow to a solid cone of fuel. In a hollow cone of fuel there are two distinct mixing zones. The first is in the outside surface of the hollow cone where air leaving the choke meets the fuel. The second is the inside of the hollow cone which does not receive air directly from the air pattern created by the choke configuration. This inside zone receives its air either from the combustion chamber (causing air to move in a direction toward the fuel nozzle rather than in the normal direction of airflow), or the air gets to this inside zone of the hollow cone by being so directed from the choke that it ruptures the cone of fuel and enters near the fuel nozzle, as shown in Fig. 5. In this case the fuel pattern established by the nozzle is disrupted in an irregular manner, producing turbulence and rough burning. The rate of this rupture of the fuel cone determines the frequency components generated by the combustion. If this random interruption rate is in the vicinity of the resonant frequency of the fire box cavity, or is pulse-like in character having pulse shapes which generate harmonics near the resonant frequency of the fire box cavity, resonance will be excited, causing rumble. The random rate at which the air, not used in combustion at the outside surface of the cone, enters the center of the cone from the fire box, determines the frequency of the combustion ignition and extinction in the center combustion zone. The mechanism and locations of burning are similar, with a solid fuel cone, since there is a similar outside surface and the inner zone, although less regular, contains a number of void spaces which are randomly supplied by air from the fire box area rather than from air supply at the choke.

Fig. 6 *(right)* — Analogous acoustical and mechanical systems


A – EQUIVALENT ACOUSTICAL SYSTEM
B – SIMPLE SPRING MASS SYSTEM
C – EQUIVALENT ACOUSTICAL CIRCUIT
D – MECH. ANALOGUE OF FURNACE

This random mixing of fuel and air creates many areas in the burning zone which have extremely different fuel air mixtures and, consequently, different combustion rates. Random combustion is the basic exciting force which produces both rumble and pulsation.

Unstable Fuel Patterns: Although unstable fuel patterns were not a problem in any of the oil burners used during this investigation, it is pertinent to show how unstable fuel patterns, which might occur in experimental systems, would help generate combustion noise. There are 2

primary oscillatory systems in the oil supply. First is the positive displacement pump which produces pulsation in fuel flow at a frequency equal to the pump revolution rate times the number of pump lobes. These pulsations in fuel flow were seen in high speed motion pictures of the fuel stream discharging from the nozzle. However, their magnitude was small and their frequency considerably above the range which might produce rumble. The second source of pulsation in the fuel system is the pressure regulator which produces changes in fuel pressure at a rate determined by the mass of the valve and the spring rate of the valve actuating mechanism when excited by a random pump fluctuation. Pulsations caused by the pressure regulator were not observed during this investigation; however, these might be present in some fuel burning systems.

Oscillatory Burning Due to Spark Ignition: Modern oil burners are ignited by a 120 cps spark from a transformer which produces 120 sparks per sec due to 60 cycle current. This tends to produce a fuel combustion pulse rate of 120 cps. If the fire box cavity happened to be tuned to this frequency there would be considerable noise amplification at 120 cps. Although this was not the case in the test unit, this fact should not be overlooked in future designs expected to result in smaller units which might have a resonant frequency in this range.

Summary of Noise Sources: Each of the turbulence generators mentioned in the preceding sections helps create the basic exciting force for both rumble and pulsation. All are important contributors to the problem. The mixing process itself, especially in the central mixing zone, seems to be the most important. In order to produce a quiet oil burner it is necessary to reduce to a minimum the creation of low frequency turbulences and to rely fully on high frequency turbulence to provide the mixing necessary for efficient combustion. In the Appendix* there is a list of suggested methods for reducing low frequency turbulences.

Effect of Fire Box and Flues on Rumble

Previous sections have mentioned the parameters involved in creating the rumble exciting force. Since all of the mechanisms mentioned produce random combustion noise in the burning zone which is inside of the unit, the effect of this internal volume must be considered in describing the rumble noise as it is heard in the adjacent space. The unit consists of a fire box, flue system and draft openings. To this is attached the oil burner, which constitutes the second major opening in the system. From an acoustic standpoint, this system is analogous to a Helmholtz resonator with 2 openings. The fire box is the cavity or acoustic compliance. The two masses or tubes of the Helmholtz resonator are the burner tube and flue system. For the purpose of rumble, the system may be considered terminated at the draft opening or barometric damper. This point may be considered the termination because changes in length and diameter of the stack beyond the barometric damper do not greatly influence the resonant frequency or the amplification of rumble.

Effect of Internal Configuration on Frequency Rumble: Fig. 6 shows a diagrammatic sketch of a Helmholtz resonator, along with the simplified equation which determines its resonant frequency.

$$\omega = \sqrt{\rho_c C^2/V \cdot S/\rho_M l_e} \quad \ldots\ldots (1)$$

where

ρ_c = density in the fire box.
ρ_M = density in the flue.
V = volume of the fire box.
S = cross-sectional area of the flue.
C = velocity of sound.
l_e = effective length of the flue.

From the equation for the resonant frequency of a Helmholtz resonator it can be seen that an increase in the size of the combustion cavity or fire box decreases the resonant frequency of the system. It can also be seen that an increase of the length of the flue passes decreases the resonant frequency. The converse of both of these statements is equally obvious. The acoustic mass of the system is actually a combination of 2 individual masses operating in parallel. The way they are added together to form the effective mass is shown in the equation below Fig. 6-C. It can be seen from this equation that it is possible to have

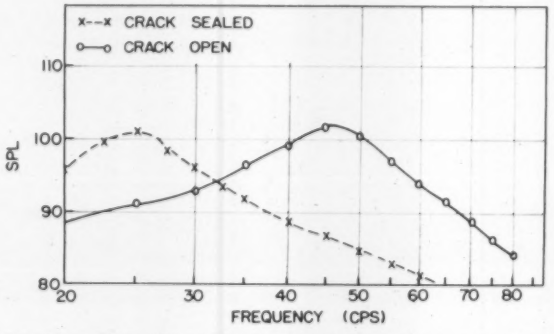


Fig. 7 — The effect of cracks on furnace resonant frequency

*It is planned to publish the Appendix with the paper in the TRANSACTIONS.

either the flue passages or the burner tube constitute the more important portion of the effective mass. When either is more important a change in it naturally has greater effect on the resonant frequency of the system. In the case of the test unit the flue passages are a little more important than the burner tube in determining the resonant frequency of the unit. Calculations and measurements of the resonant frequency of the test unit show that when the unit is cold and well sealed it has a resonant frequency of between 20 and 25 cps. Density of the gases inside the unit affects the resonant frequency. While burning with an average temperature distribution in the system the resonant frequency is approximately 40 cps instead of 20 to 25 cps. This is due to the change in density caused by the increased temperature of the gases in the flue passage. Density of the fire box gases is unimportant since density is so used twice in the equation for the compliance of the fire box that the effect of temperature is cancelled out. With regard to the masses involved, it is only in a sealed unit that the flue passes and the burner tube are the primary ones involved. As soon as cracks are opened the total mass of the system changes radically. Measurements of the natural frequency of the unit with several cracks of less than half of 1 sq in. in cross-sectional area raised the resonant frequency of the cold unit to approximately 45 cps, as shown in Fig. 7. Because cracks have such a large effect on the resonant frequency of the unit, it is not possible to measure the resonant frequency of a particular unit with any degree of accuracy unless attention is paid to sealing all cracks which might change the tuning. All of the factors just mentioned determine the frequency of the rumble. The combustion noise, if it were outside the unit, would have a relatively broad band spectrum in the low frequency range. However, when combustion takes place inside, the unit amplifies the noise at its resonant frequency. Therefore, when one listens in the basement or utility room, the rumble tends to have definite frequency characteristics determined by the unit configuration.

Effect of Unit Configuration on Rumble Amplification: Any resonant system, such as a heating unit, has a sound-pressure amplification factor, Q. The Q of the system might be roughly described as the number of times a particular input signal is amplified inside the resonant system. In the test unit it was found that this amplification factor, or Q, was between 1½ and 4. This would represent a sound-level amplification of between 3 and 12 db, 3 db being for a Q of 1.5 and 12 db being for a Q of 4. One reason for the variation in noise from so-called identical units is the number of unsealed small openings or leaks. Leaks, beside helping determine the resonant frequency of the system, also help determine the amount of damping the system has.

Leaks produce damping by two means. First, there are viscous losses in the narrow passages. The loss produced by viscosity of the fluid is proportional to the particle velocity in these small openings. The resistance of a small opening can be calculated from Equation 2.

$$R_a = 8Nl/\pi a^4 \quad \ldots\ldots\ldots\ldots\ldots\ldots (2)$$

where

R_a = acoustic resistance.
N = viscosity coefficient.
l = length of the opening in the direction of flow, and a is the equivalent radius of the opening.

Leaks also produce resistance or damping due to an airflow phenomena. Resistance created in the leaks due to airflow is proportional to the linear velocity of DC airflow through the opening divided by the cross-sectional area of the opening. Equation 3 for this particular resistance was unknown prior to the work on this program. Work carried out at the Foundation under its own sponsorship during the course of this program has established that the acoustic resistance due to DC airflow can be calculated by the equation

$$R_a = 2.12 \times 10^{-3} V_{DC}/S \quad \ldots\ldots\ldots\ldots (3)$$

where

V_{DC} = the DC velocity in centimeter per second.
S = the cross-sectional area of the opening or hole in square centimeter.

In a unit the DC airflow through leaks is created by the pressure difference between the surrounding room and the inside of the fire box. It makes no difference whether this pressure difference is positive or negative since either will cause air to flow through leaks into the unit in an at-

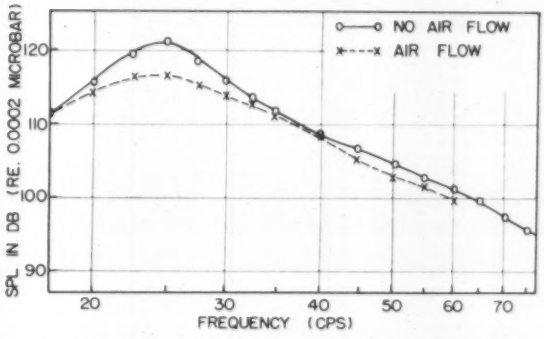


Fig. 8 — The effect of air flow on furnace amplification

tempt to reduce the pressure difference. Normally there is a negative overfire draft causing air to flow from the room into the fire box. The effect of this DC airflow on the Q of the furnace is shown in Fig. 8. This figure correlates the change in sound pressure in the fire box with a change in overfire draft. Note that a higher draft produces a response curve which indicates lower noise amplification at the resonant frequency of the unit.

DC airflow through the unit changes the damping in the system

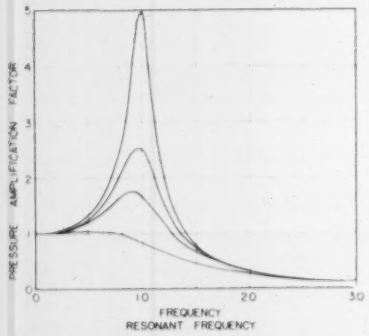


Fig. 9 — Typical response curves of a simple resonant system

by creating acoustic resistance at locations other than leaks. The airflow required for combustion flows through the burner tube and the flue passes. This creates acoustic resistance in both of these locations. The resistance created in the burner tube is more important than the resistance created in the flue passes because of the higher air velocity in the burner tube. It was mentioned in the section concerning the effect of the burner tube on rumble and pulsation that a small cross-sectional area is desirable in the burner tube. A second reason for the importance of this small cross-sectional area is to increase the DC velocity at that location so that increased acoustical resistance may be added to the resonant system. This is important from both a rumble and pulsation standpoint. It is important from a rumble standpoint because of the reduced Q of the entire system. It is more important from a pulsation standpoint, however, because in addition to reducing the Q of the system the resistance in the throat of the burner tube damps and, thereby, reduces the amplitude of any reverse flow toward the fan. The total resistance in the burner tube is the sum of the AC resistance due to DC airflow

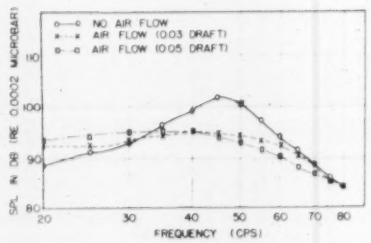


Fig. 10 — Typical furnace response curves

and the AC resistance due to viscous losses in the throat of the tube. When these resistances are increased by reducing the throat cross-section, the maximum amplitude of pulsation is reduced because of the additional damping.

The effect of damping on any resonant system can be visualized by inspecting a curve such as Fig. 9. This curve shows the change in amplification of a simple series resonant system with a change in damping or resistance. A heating unit acoustical system is not as simple as the curve indicates; however, the similarity is close enough so that a similar curve could be plotted for the exact unit being studied (see Fig. 10).

In general, most units today are similar from the standpoint of size and noise amplification. This can best be illustrated by Fig. 11, which shows a sketch of the cross-section of 2 extremely different designs along with curves of the noise output of each unit using the same oil burner and smoke stack. This comparison indicates how little can actually be done by changing internal configurations of the unit to reduce noise.

Table 1 — Effect of damper and smoke pipe size

Smoke Pipe Diam, inches	Damper Diam, inches	Sound-Pressure Level at Damper, db	Relative Power Level in Furnace Room, db
6	6	74	123
8	6	77	129
8	9	75	131

Radiation of Combustion Noise: There are several locations at which rumble and pulsation are radiated from the unit to the surrounding room. The first and usually most important is the opening at the barometric damper. In most installations this can be verified simply by listening to the rumble in the room with the barometric damper open and closed. There are, however, several other important radiation points. These include cracks, the smoke pipe wall, the air inlet on the burner, and any auxiliary ports which might be placed in the fire box to control pulsations and starting noises. The radiation resistance of sound from an opening which is small compared to the wavelength of the sound being radiated may be calculated by Equation 4.

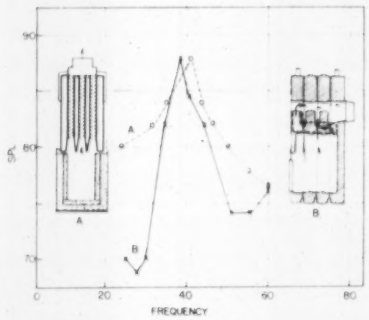


Fig. 11 — Effect of furnace configuration on low frequency noise

$$R_{RAD} = S^2 \rho \omega^2 / 2 \pi c \quad \ldots\ldots\ldots\ldots (4)$$

where

S = cross-sectional area.
ρ = density of the gas.
ω = frequency.
c = speed of sound.

The amount of sound radiated at any opening is proportional to the radiation resistance at that point. A series of measurements was made to determine the effect of damper size on sound level radiated to the room. As expected, these indicated that a large opening radiates more noise than a small opening. Measurements on the test unit indicate the difference in the sound power radiated from various smoke pipe configurations as shown in Table 1.

These results generally agree with the theoretical equations for sound radiation and should be considered in the design of any new heating unit.

Noise Considerations in Heating Unit Design: In order to insure a minimum of rumble complaints the design of units should include features which will give the most desirable results from an acoustic standpoint. There are 2 specific changes in rumble which will reduce complaints. First, the basic rumble frequency should be increased so that it will be out of the range of resonant frequency of doors, floors, and walls. It is felt that a resonant frequency in the neighborhood of 100 cps would be much less objectionable than the present typical resonant frequency of 40 cps. The second major consideration is to reduce the amplification and radiation of combustion noise as much as possible by proper unit design.

1. *The Increase of Furnace Resonant Frequency* can be accomplished in 2 basic ways. The first is to reduce the length and increase the diameter of the flue passages as much as possible. The second is to reduce the fire box volume; this type of change will shift the furnace resonance away from that of doors and walls of the building being heated.

2. *Reduction of Noise Amplification* in the unit tested, which had a low Q, was not feasible by changing the design of the unit. It was possible, however, to reduce the susceptibility of the unit to pulsation by changing basic design. This can be accomplished by increasing the cross-sectional area of the flue passages so that a specific pressure pulse in the fire box will be limited in amplitude because of more rapid release of the confined gases.

3. *Reduction of Noise Radiation* is possible by reducing the size of all openings between the fire box and the room. Since the barometric damper is generally the largest opening from which the noise emanates, it is desirable to reduce its size as much as possible. This does not mean that the smoke pipe size should be reduced but only that the size of the damper opening itself should be reduced. If a certain amount of acoustic energy is leaving the unit, this energy will be distributed into the various branches of the smoke pipe, depending on the size of these branches. A

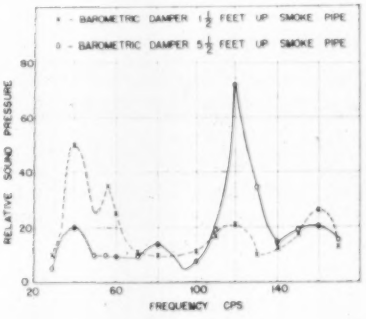


Fig. 12 — Effect of barometric damper location on frequency spectrum of rumble

smaller amount of the acoustic energy will flow through the smaller branch. Therefore, it is desirable to have the barometric damper opening small compared to the size of the smoke pipe. This will allow most of the acoustic energy to go up the stack rather than into the room. This analysis is based on the assumption that there is very little radiation into the room from the smoke pipe walls. Since this assumption is not strictly valid, and since some energy gets to the room from the smoke pipe walls, it is desirable to have the length of smoke pipe in the furnace room as short as possible. The smoke pipe is thin walled and transmits low frequency much more effectively than brick or masonry chimney.

Because of the thin walled construction of most smoke pipes, the acoustic end of the resonant system is not necessarily at the barometric damper. The thin pipe walls permit sound to be radiated and, therefore, the termination of the system takes place close to the outlet of the unit whether the barometric damper is in that location or elsewhere. Fig. 12 shows the effect of moving the damper away from the outlet in the particular configuration investigated. It will be noted from the curve that the resonant frequency of the fire box has not changed, although the radiation at the lowest frequency resonance has been reduced by moving the barometric damper away from the back of the unit.

Effect of the Room on Rumble and Pulsation

In almost all installations it is noticed that rumble can be heard much more distinctly in the corners of the room rather than in the center of the room. This is due to the increase of sound pressure near a reflecting surface. This amplification or pressure increase has been described fully in the literature. Waterhouse† gives a good summary of the phenomena involved. It is sufficient to say that, close to a single wall, the sound pressure increases 3 db. Close to a corner the sound level increases 6 db and increases 9 db close to a tri-axial corner. The word close in this case refers to a distance that is small compared to a wavelength of the sound frequency involved. The phenomena mentioned here and described in the references applies to the sound pressure with respect to a source located near the center of a hard walled room. It has also been shown that a source which is placed near a wall corner or tri-axial corner produces 3, 6, or 9 db more sound than would the same source in the center of the room. This is also described by Waterhouse‡. It is not possible to reduce the sound pressure amplification near a wall or corner from a source in the center of the room. However, it is possible to reduce the amplification of sound which would take place if the source were placed in the corner of the room. It is, therefore, suggested that where possible heating equipment be installed as far as possible from any wall in order to reduce furnace rumble between 3 and 9 db from what it would be with the source near a wall or corner. The best location would be approximately 1/3 to ½ wavelengths from the nearest wall. For a resonant frequency of 40 cps this would be a distance of ap-

† On Standard Methods of Measurement in Architectural Acoustics, by R. V. Waterhouse (*Acoustical Society of America*, Vol. 29, 1957, p. 544).

‡ Out Put of a Sound Source in a Reverberation Chamber and Other Reflecting Environments, by R. V. Waterhouse (*Acoustical Society of America*, Vol. 30, 1958, p. 4).

proximately 7 to 12 ft. It is realized this would often be impractical, but in certain situations may be helpful.

Considerations for the Reduction of Pulsation

To prevent pulsation, the head produced by the fan must be greater than the head loss in the blast tube plus the head loss in the flues plus the pressure of any random pulse created in the fire box by rough combustion. Once the sum of these 3 pressures exceeds the pressure delivered by the burner fan continuous pulsation will take place. Therefore, it is desirable to have a fan which delivers a substantial pressure, perhaps as much as 2 to 3 in. of water. It is also desirable to have as small a head loss as possible in the flues. Having a small flow resistance at this location helps prevent excessive pressures in the fire box as a result of random fluctuations in burning. The amplitude of the random burning fluctuations should be kept to a minimum in a manner similar to that described in the sections concerning the rumble exciting force.

A high pressure drop should be maintained in the burner tube even though this requires a larger fan to deliver sufficient air to the mixing region. A high head loss at this location does 2 things: first of all, it reduces the effect on the fan of any pressure pulsation in the cavity; it also requires that there be a high velocity in the throat to the burner tube. This high velocity creates acoustic resistance in the burner tube and, thus, absorbs some of the energy which might try to build up the pressure at the fan discharge with consequent reduction in fan delivery. The high velocity in the throat of the burner tube results in a high velocity head which opposes any reversal in airflow. This high velocity head is just as efficient as high static head in reducing the effect of pulsations in the fire box on the mass flow of air into the mixing region provided the throat area is small. The ideal but impractical solution to the problem would be to have a 100 psi air supply throttled through a very small orifice in the burner tube. In this case, a pressure fluctuation in the fire box of perhaps 1/10 lb per sq in. would only change the pressure drop across the orifice 1/10 of 1 percent. This would have a negligible effect on the mass flow through the orifice and would insure that the air delivered to the mixing zone was constant within the 1/10 of 1 percent. In order to cause a system like this to pulsate it would be necessary to restrict the flue passages enough so that the static pressure in the fire box was increased to 99.9 lb per sq in. To reduce the amplitude of any pulsation which might take place, it is desirable that the fan have a steep pressure-volume curve. This type of curve can be obtained with a fully backward curved fan. The steep pressure-volume curve reduces pulsation amplitude by resisting any tendency for airflow to decrease. A sudden reduction in volume flow increases the fan delivery pressure very sharply and, thus, creates more energy to force the air through the throat of the blast tube. A fan with a flat pressure flow curve does not give this added energy to the system.

Acknowledgments

During the course of this program almost everyone in the acoustics group made a substantial contribution. The work done was directed by Drs. H. C. Hardy and R. W. Benson, and supervised by the author. The analyses and test work were performed by numerous members of the group, with major roles being played by W. E. Lawrie, E. G. Grimsal, G. L. Bonvallet, and C. S. Caccavari. The advice and council of F. G. Tyzzer was very valuable during the course of the entire program. The staff of the Foundation is indebted to M. W. McRae and John G. Pecis, of Crane Co., for their guidance of this program and, also, for the procurement of numerous pieces of apparatus.

ASHAE
ANNUAL MEETINGS AND EXPOSITIONS

Philadelphia—1959

65th Annual Meeting, January 26-29, 1959

14th International Heating and Air-Conditioning Exposition, January 26-30, 1959

Dallas—1960

66th Annual Meeting, February 1-4, 1960

2nd Southwest Heating and Air-Conditioning Exposition, February 1-5, 1960

Central Philadelphia skyline

Historic Philadelphia Is Site For Annual Meeting in January

Philadelphia, *Cradle of American Liberty* and site for the 65th Annual Meeting of the Society in January 1959, is one of the oldest cities in the United States and a veritable treasure-place of historic landmarks carefully preserved through the years.

The 65th Annual Meeting will be held January 26-29, 1959 with the Bellevue-Stratford Hotel as registration headquarters. John Everetts, Jr., chairman of the ASHAE Program and Papers Committee, E. K. Wagner, general chairman of the Philadelphia Chapter Committee on Arrangements, have developed a program for this Annual Meeting which will present a challenging array of papers and an entertaining schedule of special events.

Pres. E. R. Queer, University Park, Pa., will open the 65th Annual Meeting on Monday morning, January 26, at the first of 7 sessions. It is planned to present a Topical Session on human comfort as it is related to indoor environment, a Symposium on hydronics, another on heat-pump performance and a third Symposium on corrosion and water treatment.

In addition the Program and Papers Committee has selected papers related to residential heating subjects, including the location of basement heating supply outlets, pulsations in single-port gas-fired equipment, and the low frequency combustion noise in oil-burning units. Some other topics are concerned with a new way to calculate radiant exchanges, the heat gain through windows shaded by metal awnings, and a probe for the thermal conductivity measurement of dry and moist material.

The Topical Session on Monday morning will be comprised of three papers on Comfort; they are as follows: Researches on Heating and Ventilation in Relation to Human Comfort, by Thomas Bedford, London School of Hygiene and Tropical Medicine, London, England; Metabolic Patterns in Stressful Environments, by Dr. Nello Pace, Department of Physiology, School of Medicine, University of California, Berkeley, California; Re-evaluation of the Comfort Chart, by B. H. Jennings, director of research, ASHAE Research Laboratory, Cleveland, Ohio.

The Symposium on Hydronics which will be presented on Tuesday morning at the Third Session will consist of four presentations: Design of Water Piping Systems, by B. L. Sturdevant, Muscatine, Ia.; Noise and Vibration in Water Piping Systems, by W. L. Rogers, Evanston, Ill.; Selection of Pumping Equipment, by G. F. Carlson, Morton Grove, Ill.; and Refrigerant Piping, by J. R. Chamberlain, York, Pa.

The 3 big events planned by the Philadelphia Chapter Committee on Arrangements are a Monday Welcome Luncheon, Monday evening Get-Together, and the Annual Ban-

quet on Wednesday evening. In addition they are developing many other events which will be of interest to everyone, including the ladies and children.

Society members and their families in attending the Annual Meeting, whether traveling to Philadelphia for the first time or not, will find it a most rewarding trip. Apart from the information gained by participation in the 7 technical sessions and attendance at various committee meetings there also will be the 14th International Heating and Air-Conditioning Exposition.

E. K. Stevens, president of the International Exposition Co., New York, N. Y., which manages the International Heating and Air-Conditioning Exposition under the auspices of the Society, reports that the 1959 Exposition, to be held at Convention Hall, will combine displays of the many kinds of equipment required to compensate for the influence of weather on industrial operations as well as on human comfort. Admission to the Exposition will be by invitation and registration only; the general public will not be admitted.

For those hours not assigned to Society activities, members and their families can participate in planned tours or make up their own list of places to see in Philadelphia. To mention but a few, there are Independence Hall and the Liberty Bell, Congress Hall, Betsy Ross' Home, Benjamin Franklin's grave, and Christ Church where both Washington and Franklin worshipped.

City Hall and Penn Center at twilight

As the week progresses, and if time permits, also of interest are the home of Samuel Powel, Philadelphia's mayor before and after the Revolution; Carpenter's Hall, and the Atwater-Kent Museum which contains scale models of early Philadelphians, their city, homes and clothing. By taking a short drive to Germantown it is possible to visit Morris House, the nation's White House in 1793 and 1794.

The Philadelphia Chapter reports that the hotel reservation forms, mailed to Society members during the summer, are being received by the hotels, but they strongly urge that all unnecessary delay be avoided in making reservations because of the large attendance anticipated for the Annual Meeting and Exposition.

TYPICAL TRANSPORATION RATES* TO PHILADELPHIA FROM CHAPTER CITIES

City	Round Trip By Air	1st Class Round Trip By Rail	One Way Roomette	One Way Seat†
Albany, N. Y.	$ 21.42	$ 21.34	$ 9.70	$2.92
Albuquerque, N. M.	225.25	174.45	33.80	
Atlanta, Ga.	91.40	64.09	13.80	
Austin, Tex.	205.02	131.36	24.75	
Baltimore, Md.	13.90	10.80		1.27
Baton Rouge, La.	151.20	140.00	20.70	
Boston, Mass.	35.55	25.03	9.70	3.20
Buffalo, N. Y.	44.50	40.00	8.10	3.40
Charlotte, N. C.	63.10	44.29	9.95	
Chicago, Ill.	84.10	88.20	13.25	
Cincinnati, Ohio	69.25	70.65	12.20	
Cleveland, Ohio	46.60	52.00	9.70	
Columbia, S. C.	66.60	51.59	11.05	
Columbus, Ohio	54.55	58.25	11.45	
Dallas, Tex.	157.50	129.85	25.25	
Dayton, Ohio	63.08	65.80	11.95	
Denver, Colo.	196.84	160.15	28.20	
Des Moines, Ia.	122.26	113.10	13.25	2.50
Detroit, Mich.	57.00	69.40	11.85	
Edmonton, Canada	296.50	186.70	29.85	
El Paso, Tex.	229.05	179.15	33.80	
Grand Rapids, Mich.	79.10	77.40	11.85	
Greensboro, N. C.	53.20	36.99	9.70	
Hartford, Conn.	25.38	23.88		2.15
Houston, Tex.	173.16	140.40	25.85	
Indianapolis, Ind.	74.25	77.65	12.25	
Jackson, Miss.	125.19	92.55	20.70	
Jacksonville, Fla.	93.51	75.59	17.10	
Johnstown, Pa.	27.18	30.65	9.70	
Kansas City, Mo.	124.65	120.10	19.70	
Little Rock, Ark.	132.43	104.50	19.70	
Los Angeles, Calif.	290.88	221.65	45.00	
Louisville, Ky.	74.25	79.90	13.25	
Lubbock, Tex.	194.58	166.65	33.05	
Memphis, Tenn.	116.60	87.60	18.65	
Milwaukee, Wis.	84.10	94.15	13.25	1.05
Minneapolis, Minn.	116.66	116.50	13.25	2.40
Montreal, Canada	53.30	49.10	9.70†	
Newark, N. J.	15.50	9.32		1.27
New Orleans, La.	143.30	100.40	20.70	
New York, N. Y.	15.50	10.16		1.27
Norfolk, Va.	36.00	32.57	9.70	
Okla. City, Okla.	160.27	118.01	23.75	
Omaha, Nebr.	136.74	122.80	19.70	
Ottawa, Canada	63.30	58.05	10.90†	
Phoenix, Ariz.	235.42	201.06	40.65	
Portland, Ore.	307.10	204.00	45.00	
Pittsburgh, Pa.	35.10	38.75	9.70	3.25
Sacramento, Calif.	306.85	227.65	45.00	
St. Louis, Mo.	98.19	104.50	16.00	
Salt Lake City, Utah	249.38	191.90	33.80	
San Antonio, Tex.	185.01	148.35	29.15	
San Francisco, Calif.	290.88	227.65	45.00	
Savannah, Ga.	80.37	62.44	14.40	
Seattle, Wash.	351.00	204.00	45.00	
Shreveport, La.	146.79	104.60	20.70	
Spokane, Wash.	277.00	184.20	42.50	
Springfield, Mass.	26.79	26.68		2.50
Syracuse, N. Y.	35.10	26.61		4.42
Toledo, Ohio	57.00	63.30	11.85	
Toronto, Canada	64.30	48.37	8.10	
Tulsa, Okla.	146.65	114.71	22.20	
Vancouver, Canada	322.80	204.00	36.55	
Washington, D.C.	18.90	15.14	9.70	1.82
Wichita, Kan.	154.66	118.01	23.75	
Winnipeg, Canada	171.90	132.25	21.25	

*Above rates subject to 10% tax (except from Canada). Rates subject to change without notice.
†Indicated where transportation included both parlor chair and sleeping accommodations.

Society Nominations for 1959

The Nominating Committee, which was selected as provided in Article VIII — *Section 3* of the Society's By-Laws, has submitted its nominees for Officers and members of the Council for 1959, and the Council, in accordance with Article VIII — *Section 4*, has announced its nominees for election to the Committee on Research. Proxy ballots containing the names of the candidates will be sent to the membership prior to the Annual Meeting in January.

Report of Nominating Committee

President
Arthur J. Hess, Los Angeles, Calif.

First Vice President
Walter A. Grant, Syracuse, N. Y.

Second Vice President
John Everetts, Jr., Philadelphia, Pa.

Treasurer
John H. Fox, Toronto, Ont., Canada

Members of Council (*Three-Year Term*)
*Wm. J. Collins, Jr., Oklahoma City, Okla. (Region 6)
Harold A. Lockhart, Morton Grove, Ill. (Region 2)
*George W. F. Myers, St. Louis, Mo. (Region 3)
Rolland S. Stover, Marshalltown, Ia. (Region 3)

Respectfully submitted,

NOMINATING COMMITTEE
A. W. Edwards, *Chairman*
G. H. Meffert, *Secretary*

*Regional Director.

Nominees for Committee on Research

The election of the Committee on Research is governed by the By-Laws for the election of Officers, with the exception that members of the Committee on Research are nominated by the Council.

In accordance with the provision of **Article VII** — *Section* 3, **General Committees** (*h*) *Committee on Research*, the Council announces the nomination of the following members of the Committee for election to succeed those members whose present terms expire January 1959.

Committee on Research (*Three-Year Term*)
Albert Giannini, New York, N. Y.
R. C. Jordan, Minneapolis, Minn.
Maurice Nelles, Chicago, Ill.
H. B. Nottage, Burbank, Calif.
P. H. Yeomans, Philadelphia, Pa.

By-Law Provisions on Nomination and Voting

Article VII—*Section 3*, **General Committees.**
(*h*) *Committee on Research*, consisting of fifteen (15) MEMBERS, nominated by the Council or as provided in **Article VIII**, *Section 4*, and elected by the Society in the manner of elected officers.

Article VIII—*Section 3*, **Nominating Committee.** The Nominating Committee, to serve for a term of one (1) year from the opening of the Annual Meeting, shall consist of eleven (11) MEMBERS and sixteen (16) alternate MEMBERS, all of whom shall have been in good standing as MEMBERS for a period of at least (5) years. Four (4) members and one (1) first alternate and one (1) second alternate member of the said committee, each from a different Regional Area, shall be selected by the Council at or prior to its last quarter-annual meeting, and one (1) member and one (1) first and one (1) second alternate member shall be selected by each Chapters Regional Committee, and certified to the Executive Secretary by September 1 of each year. No member of the Council shall be eligible to serve on the Nominating Committee, and no Chapter shall be represented on the said committee by more than one (1) of the eleven (11) MEMBERS. The Nominating Committee so chosen shall effect its own organization during the Annual Meeting of the Society, and shall hold a meeting during the Semi-Annual Meeting of the Society. By September 1 of each year the Nominating Committee shall nominate candidates for the elective offices, the members of the Council and the Regional Directors to be elected at the ensuing Annual Meeting, and notify the Executive Secretary of the names of the nominees, the notice to be accompanied by the written acceptances of the candidates. Seven (7) members entitled to vote on the said committee shall constitute a quorum. No alternate member may be present at committee meetings, nor shall he participate in the deliberations thereof or vote therein except in the absence of the member, or the member and the first alternate member of the one of the eight (8) groups with which he was selected. The transportation expenses, as defined by the Council, of eleven (11) committee members who participate in the deliberations at the annual and semi-annual meetings of said committee shall be included in the budget and defrayed by the Society.

Section 4, **Other Nominations.** Nominations of officers and members of the Council, other than those nominated by the Nominating Committee, and nominations of members of the Committee on Research, other than those nominated by the Council, may be made in writing by at least fifty (50) members eligible to vote, upon presentation of such nominations, with each nominee's consent, to the Executive Secretary at least sixty (60) days prior to the opening of the first session of the Annual Meeting, whereupon the nominees' names shall be placed upon the ballot with a notation that they are presented by members independent of the Nominating Committee.

Section 5, **Voting.** Voting at any meeting may be in person or by proxy, but only the Executive Secretary and MEMBERS of the Society shall be eligible to act as proxies. Proxies shall not be valid for more than three (3) months from dates of execution. The Executive Secretary and the MEMBERS acting as proxies shall hold the ballots of their principals secret and confidential. Voting for election of Officers, Council members, members of the Committee on Research, on proposals to amend these By-Laws, and on questions required to be referred to the Society pursuant to **Article V**, *Section 2*, shall be by secret ballot. In the event of any tie vote, the Council shall decide the vote.

Section 6, **Ballots.** Together with notice of the Annual Meeting, the Executive Secretary shall forward appropriate proxies and ballots to members entitled to vote. The proxies and ballots shall contain spaces for write-in names.

Biographies of 1959 Nominees

Officers

For President — ARTHUR J. HESS, president of Hess, Greiner & Polland, Los Angeles, Calif., is currently serving as 1st vice president. He was 2nd vice president and chairman of the Regions Central Committee in 1957 and served previously as regional director of Region 4. He has been a member of the Council since 1954, was chairman of the Finance Committee in 1956, after 2 years as a member, and is currently chairman of its Executive Committee. He was a member of the latter committee last year.

Mr. Hess was born in Pasadena in 1904. He studied civil engineering at the University of California at Los Angeles, at Berkeley, and at the University of Southern California. In 1928 he became a plumbing and heating contractor and from 1930 to 1936 was a consulting engineer. During that time he also taught night courses for the Los Angeles Board of Education.

Mr. Hess has been engaged in the application and sale of engineering products for more than 30 years. He has worked on numerous projects, including stages at the 20th Century-Fox Studios; the heating, ventilating and air conditioning for the co-op wind tunnels at Pasadena and at Curtiss-Wright; and the Earhart Research Laboratory, California Institute of Technology.

Mr. Hess has been a member of the Society since 1937 and an active leader of the Southern California Chapter. He was chapter president in 1941, having previously served as treasurer, secretary, and vice president.

Interested in Society activities, he is currently chairman of the F. Paul Anderson (Honors and Awards) Committee; Alternate Representative to the *Engineers Joint Council*; and a representative to the Joint ASHAE-*ASRE* Committee on Environment Studies. He was chairman of the Chapters Conference Committee, 1952. He has also been a member of the Long-Range Planning Committee, 1953-55.

An active promoter of ASHAE, he was a member of the Committee on Promotion of Research, 1949; Chapter Relations Committee, 1950-52 and 1955; and the Committee on Research, 1950-53. Mr. Hess held membership on the following Research Technical Advisory Committees: Corrosion, 1950; Air Cleaning, 1951-55; Sensations of Comfort, 1949-57; Evaporative Cooling, 1953-55; and on Plant and Animal Husbandry, 1952 to date, serving as its present chairman.

A past president of *ASRE*, Mr. Hess was named an *ASRE* representative for the ASHAE-*ASRE* Committee on Cooperation, and as the ASHAE representative on the U.S. National Committee of the *International Institute of Refrigeration*. He is also a member of the *Air Pollution Control Association*, Free and Accepted Order of Masons, Shriners, Kappa Alpha and Chi Epsilon.

Mr. Hess is the author of several articles, including Air Conditioning in Moving Picture Studios, Evaporative Cooling, Air Conditioning in Film Laboratories, and Plant Research in the Phytrotron. He is listed in *Who's Who in Commerce and Industry* and *Who's Who on the Pacific Coast*.

For First Vice President — WALTER A. GRANT is vice president and assistant to the president of Carrier Corporation, Syracuse, N. Y. He was born in 1904, in Brooklyn, N. Y., is a graduate of Columbia University, and has received his A.B., B.S., and M.E.

Mr. Grant joined Carrier in 1928 as a student engineer. He successively served as application engineer, development engineer, Eastern regional chief engineer, director of application engineering and director of research. He became vice president of the company in 1953, and served as head of the Research and Development Division from 1954 through 1957.

A member of the Society since 1929, he is now its 2nd vice president. Mr. Grant has served on the Committee on Research 1949-52; TAC on Odors, 1949-52, vice chairman, 1953; TAC on Sensations of Comfort, 1949-51; vice chairman, TAC on Air Distribution, 1952-54; and the 1952 and 1953 Nominating Committees. During the 3-year term on Council which he completed last year, Mr. Grant served as a member of the Finance Committee, 1955-56, and as its chairman, 1957; as a member of the Long-Range Planning Committee, 1956; the Nuclear Energy Engineering Committee, 1956-57; Program and Papers Committee, 1955, chairman in 1956; and Advisory Committee chairman, 1957. He served as the Society's *AAAS* representative for 1957-58. This year he is a member of the Executive Committee of the Society's Council, chairman of the Regions Central Committee, and a member of the Exposition Committee.

Mr. Grant is a member of the Central New York Chapter and served on its 1952 board of governors.

Co-author (with W. H. Carrier and R. E. Cherne) of the textbook *Modern Air Conditioning, Heating and Ventilating*, Mr. Grant has also written numerous technical articles and has contributed material for THE GUIDE and *ASRE Data Book*.

Mr. Grant is listed in *Who's Who In Engineering*, in *American Men of Science*, in *Who's Who in Commerce and Industry*, and in the forthcoming *Who's Who in America*. He is a member of *ASRE*, *AAAS* (fellow), Tau Beta Pi, Sigma Xi, Phi Gamma Delta and the University Club, and is a licensed engineer in N. Y. and N. J.

Arthur J. Hess
Los Angeles, Calif.

Walter A. Grant
Syracuse, N. Y.

John Everetts, Jr.
Philadelphia, Pa.

John H. Fox
Toronto, Ont., Canada

For Second Vice President — JOHN EVERETTS, JR., consulting engineer with Charles S. Leopold, Philadelphia, was born in Brooklyn on March 14, 1905.

He attended Brooklyn Polytechnic Institute, graduating in 1929 with an M.E. degree. Prior to and while attending school, Mr. Everetts was associated with the W. L. Fleisher Co., Inc., New York. He worked for them for six years in the designing and testing field. Upon graduation he joined the Richardson & Boynton Co. of Dover, N. J. and was in charge of their research laboratory. In 1933 he became secretary-treasurer of the Air & Refrigeration Corp., New York, and until 1938, was responsible for engineering and

design of industrial and commercial air conditioning. After leaving this position, Mr. Everetts was employed as zone engineer with the Frigidaire Division of General Motors Sales Corp., Dayton, Ohio. In 1942 he served with Blaw-Knox Co., Blawnox, Pa., as engineer in charge of blast furnace dehumidification design.

Mr. Everetts was commissioned in July 1942 as a Lieutenant in the Naval Reserve and assigned to duty in the Bureau of Ships, where he served as West Coast representative of the Air Conditioning Section, handling all technical problems as well as the distribution of equipment for heating, ventilating and air conditioning of naval vessels at all West Coast and Pacific advanced base activities. In 1944 he was promoted to the rank of Lieutenant-Commander, and in 1945, to Commander.

After his discharge in 1946, Mr. Everetts formed a partnership with T. H. Urdahl as Urdahl and Everetts, consulting engineers in Washington, D. C. He joined the staff of Charles S. Leopold in 1949.

An extremely active member of the Society which he joined in 1929, Mr. Everetts was elected to Council in 1956, and has served as chairman of the Council's Program and Papers Committee for the past two years. Other Council Committees in which he has held membership are Finance, 1958; Long-Range Planning, 1956-58; ASHAE-*AIA*, 1957-58; F. Paul Anderson, 1957; and Regional Director of Region 1, 1956-57.

He was elected to the Committee on Research in 1951 for a three-year term; he was re-elected in 1954 for another three years, and was its vice-chairman in 1955. While on the Committee on Research, he was chairman of the Long-Range Research Program in 1956 and a member of the Executive Committee.

Mr. Everetts has served on many of the Research Technical Advisory Committees. He was chairman of Weather Data from 1953-58, and of Sorbents from 1944-50; from 1952-56 he was vice-chairman of Sorption, and in 1952-55 of Sensations of Comfort. Mr. Everetts also served as chairman of Physiological Research and Human Comfort, 1958; Plant and Animal Husbandry, 1953-57; Cooling Load, 1951-54; Panel Heating and Cooling, 1950-55; Cooling Load in Summer Air Conditioning, 1938-44; Weather Design, 1938-46; Air Conditioning of Residences, 1934-1941.

Active in Chapter activities, Mr. Everetts served on the board of governors of the Golden Gate, Washington, D. C., and Philadelphia Chapters. He was vice-chairman of the Committee on Arrangements for the Society's 61st Annual Meeting in Philadelphia in 1955.

Mr. Everetts is also a member of the Philadelphia Engineers Club. He has written several papers which have been presented at Society Meetings and published in the Society's TRANSACTIONS. Aside from his duties as consulting engineer with Charles S. Leopold, he is a visiting professor on the engineering staff at Columbia University.

For Treasurer — JOHN H. FOX, treasurer of ASHAE and vice president-sales, Honeywell Controls, Ltd., Toronto, Ont., Canada, has been a member of the Society since 1935. He served on the Council from 1951 to 1956 and was regional director of Regional Area 7 in 1956.

Mr. Fox was born and educated in Toronto and graduated from the University of Toronto in 1927 with a B.A.Sc. The following year he was employed by the University as a demonstrator in its hydraulics department. He then worked for 6 years as assistant to the chief engineer at C. A. Dunham Co., Ltd. In 1935 he joined the Minneapolis-Honeywell Regulator Co. as a sales and application engineer.

During World War II Mr. Fox, a lieutenant colonel with the Royal Canadian Electrical and Mechanical Engineers in Europe, was decorated with the Order of the British Empire. He rejoined the Minneapolis-Honeywell Co. in 1946, becoming sales manager of the Commercial Controls Division. He became manager of the Central Region in 1951, general sales manager in 1953, and vice president-sales in 1956.

Mr. Fox was a member of the board of governors of Ontario Chapter, 1938-39 and 1946-48. He was Chapter vice president in 1949 and was elected president in 1950.

He has been active on the following Society Committees: Chapter Delegates, 1949; Chapters Conference, 1950 and 1952; Program and Papers, 1951-52; Chapter Relations, 1950, 1955; and Membership, 1954. From 1954 to 1955 he was chairman of the Special Committee To Codify Council Policies; he was chairman of the Public Relations Committee during 1955-56 and has since served as a member of the committee.

He is currently serving as a member of the Executive Committee of the Council and as ex officio member of the Finance Committee.

Mr. Fox was president of the *Association of Professional Engineers of Ontario* in 1957. He also holds membership in the *Engineering Institute of Canada*, *Institute of Mechanical Engineers* (London), Engineers Club of Toronto, Royal Canadian Military Institute of Toronto, Toronto Board of Trade, Canadian Club and Empire Club. He is a past master of the University Lodge, A.F. & A.M.

Members of Council
(*three-year term*)

WM. J. COLLINS, JR., consulting engineer and president of his own engineering firm, was born at Iron River, Mich. He attended Michigan College of Mining and Technology from 1931 to 1935.

During the next year he was employed as assistant operating engineer, Swift & Co., Clinton, Ia. In 1936-37 he worked as engineer with the C. A. Dunham Co., Marshalltown, Ia. As a sales and consulting engineer, Mr. Collins joined the Loefflер-Greene Supply Co., Oklahoma City, retaining this position until 1941. He later became a mechanical engineer with The Austin Co., Fort Worth, Tex. Military service interrupated his career in 1942, and for the next 4 years he served as an officer with the Corps of Engineers in the U. S. Army. In 1946, he entered into a partnership as Collins and Gould, consulting engineers, with offices in Tulsa and Oklahoma City. In 1955 the firm was dissolved, and Mr. Collins established his own firm of consulting engineers in Oklahoma City.

Mr. Collins has been a member of the Society since 1949. From 1950 to 1954 he was on the Chapters Conference Committee, serving as Chairman in 1954. He served on the Nominating Committee in 1955 and on the Publication Committee for the next 2 years, serving as its chairman in 1957.

Within the Oklahoma Chapter, Mr. Collins has held numerous chapter offices; he was secretary from 1950-52, president in 1952-53, and a member of the board of governors from 1953-57.

Mr. Collins also belongs to the *Oklahoma Society of Professional Engineers*, the *National Society of Professional Engineers*, the *American Society of Sanitary Engineering*, the *Society of American Military Engineers*, and the *Consulting Engineers Association of Oklahoma*, of which he is president.

HAROLD A. LOCKHART, vice president and chief engineer, Bell & Gossett Co., Morton Grove, Ill. was born at Nashville, Tenn. In 1929 he was graduated from the University of Minnesota with a B.S. in mechanical engineering.

For the past 24 years, he has been chief engineer at Bell & Gossett Co., where he has been in complete charge of the engineering department. His promotion to vice president was announced in 1954.

Mr. Lockhart joined the Society in 1935, and has served on its Committee on Research since 1950 becoming vice-chairman in 1956 and chairman in 1957. He has served on the Research Executive Committee since 1955, and was a member of the Long-Range Research Program in 1956-57. Mr. Lockhart has served on several Research Technical Advisory Committees as follows: Panel Heating and Cooling since 1948; Hot Water and Steam Heating, 1950-

56, chairman 1956; Sound and Vibration Control, chairman 1952-56; Plant and Animal Husbandry since 1953, vice-chairman in 1956.

He is a licensed engineer in the State of Illinois, and also belongs to the *American Society of Mechanical Engineers*, and Theta Tau and Pi Tau Sigma fraternities.

Wm. J. Collins, Jr.
Oklahoma City, Okla.

Mr. Lockhart is listed in *Who's Who* in Poor's Register of Directors and Executives.

H. A. Lockhart
Morton Grove, Ill.

ROLLAND S. STOVER, 1950 president of the Society's Iowa Chapter and owner of the R. S. Stover Co., Marshalltown, Ia., was born in Blairstown, Mo. He was graduated from the University of Kansas in 1933 with a B.S. in Mining Engineering.

For the next two years, Mr. Stover served as a student engineer with the Gypsy Oil Co., Tulsa, Okla. In 1935 he accepted a position as sales engineer with the Smith Separator Corp., Tulsa. From 1939 to 1943 he was a sales engineer for the Fisher Governor Co., Marshalltown. In 1943 he organized the R. S. Stover Co. which he has operated in Marshalltown since that date.

Mr. Stover has held numerous Iowa Chapter offices since he joined the Society in 1944. He served as secretary-treasurer in 1948-49; as vice president in 1949-50; and was elected president for the 1950-51 term. He was on the board of governors from 1951-53, and since that time, has been a representative at Society Annual, Semi-Annual and Regional Meetings. In 1955, Mr. Stover was secretary of the Chapters Conference Committee, and is currently serving as a member of the Public Relations Committee.

Mr. Stover also has held all *ASME* Chapter offices from secretary through chairman, having been chairman in 1951-52. He holds membership in the *Iowa Engineering Society* of which he was president in 1955-56. This Society presented him with the Anson Marston award in 1951. In March, 1956 Mr. Stover was selected *Engineer of the Month* by The Central Constructor.

He is a member of the *ISA*, Rotary, Moose, Elks, Phi Mu Alpha, and the Marshalltown Chamber of Commerce. Mr. Stover was recently nominated by the University of Kansas to *Who's Who in Engineering*.

G. W. F. Myers
St. Louis, Mo.

GEORGE W. F. MYERS, owner of the Myers Engineering Equipment Co., St. Louis, was born and educated in Philadelphia. He obtained his engineering education at Drexel Institute of Technology. He has a B.S. in economics from Washington University.

Prior to 1925 Mr. Myers was an assistant to the chief engineer of the York Heating & Ventilating Corp., designing heating, ventilating and exhaust systems for the paper, woodworking and textile industries. He was then transferred to the sales department and was part owner of the Philadelphia office. In 1929 he was made district representative of the St. Louis office and after the company's merger with Carrier Engineering Corp. he remained in that capacity until 1932 when he organized the Myers Equipment Co., to serve architects, engineers, and industry in product application.

Mr. Myers has been active in the St. Louis Chapter for many years. In 1934 he was treasurer of the Chapter, vice president, 1935-36, president in 1937, and a member of its board of governors in 1938. He is currently serving as the St. Louis Chapter representative on the *Engineers Joint Council*.

Mr. Myers has served on numerous Society Committees such as: Nominating in 1938 and 1948; Chapter Delegates, 1947-48; Chapter Relations in 1947; Charter and By-Laws from 1950-53, serving as its chairman the latter year; and the Executive Subcommittee on Operational Guides 1954.

In 1941 he was instructor in air-conditioning at the City College of Law and Finance, St. Louis.

Mr. Myers is a registered professional engineer in the State of Missouri; a member of the Engineers Club of St. Louis and a past member of its Board of Directors; president of the Metropolitan Toastmasters Club in 1947; president, St. Louis Chapter of *Missouri Society of Professional Engineers*, 1950; and State Director of the *MSPE*, 1951-53.

R. S. Stover
Marshalltown, Ia.

Committee on Research
(*three-year term*)

Albert Giannini
New York, N.Y.

ALBERT GIANNINI, district manager of the New York office, Carrier Corporation, has been a Society member since 1947. He was graduated from New York University where he received a B.S. in mechanical engineering. Subsequent to his graduation, Mr. Giannini joined the Consolidated Edison Co. of New York as a gas utilization engineer. In 1937 he became a sales engineer with Bryant Air Conditioning Corp. Since 1941 he has been connected with Carrier Corporation.

Mr. Giannini served as an instructor at Brooklyn Evening Technical High School from 1938-41, when he returned to New York University as an instructor.

He has served the Society on numerous of its committees. In 1954 he was appointed to serve on the Guide Committee for a 3-year term, serving as its chairman in 1956. He was a member of the Chapters Regional Committee in 1957, and that same year was appointed to serve for a 3-year term on the Standards Committee, and is currently serving on its subcommittee on Minimum Outdoor Air Requirements for Air Conditioned Spaces.

As an active member of the New York Chapter, Mr. Giannini served as its vice

president in 1954, was elected to the presidency in 1955, and was a member of its board of governors in 1950, 1953, and in 1956.

Mr. Giannini is the *Mechanical Contractors Association* representative for the *NFPA* Committee on Air Conditioning.

RICHARD C. JORDAN, professor and head, department of mechanical engineering, University of Minnesota, Minneapolis, Minn., has spent his educational and professional career largely in connection with the University. He was awarded a Ph.D. from the University of Minnesota in 1940, having previously received a B.S. in aero engineering, 1931, and an M.S. in mechanical engineering in 1933.

Following a few years in charge of the Air Conditioning Division of Central Supply Co., Minneapolis branch of American Radiator and Standard Sanitary Corp., and a year as instructor in petroleum engineering at the University of Tulsa in Oklahoma, Professor Jordan returned to the University of Minnesota in 1937 as an instructor in the Engineering Experiment Station. He successively became assistant director of the Engineering Experiment Station, assistant professor, and then associate professor. In 1944 he assumed the directorship of the Industrial Laboratory. He was named a full professor in 1946, and has served as head of the Department of Mechanical Engineering since 1951.

A member of the Society since 1933, Professor Jordan is completing a 3-year term as a member of the Committee on

various posts in that Society, culminating in the presidency in 1953. He also holds membership in *ASEE, ASME, American Ordnance Association, AAAS, AAUP, Association for Applied Solar Energy*, Minneapolis Engineers Club, *Minnesota Federation of Engineering Societies, Minnesota Society of Professional Engineers, National Society of Professional Engineers* and *Institut International du Froid*, as well as Tau Beta Pi, Sigma Xi and Pi Tau Sigma. He is a registered professional engineer in the state of Minnesota.

Professor Jordan has written extensively for technical engineering journals on refrigeration, heating, ventilating, air conditioning, dust control, mechanical engineering, and education. He is the co-author of three volumes: *Refrigeration and Air Conditioning, Aids to Technical Writing* and *Air Conditioning*. Since 1946 he has been on the board of abstractors for *Refrigeration Abstracts*.

The Outstanding Publications Award was bestowed upon Professor Jordan by *ASRE* in 1949. In 1954 he became a member of the division of engineering and industrial research of the *National Research Council* and a consultant on the Advisory Panel for Engineering Societies, National Science Foundation. At the 9th International Refrigeration Congress held in Paris in 1955, he represented the *National Research Council* as delegate; and the *Engineers Council for Professional Development*, as honorary vice president. He is currently chairman of the U. S. National Committee and U. S. delegate to the *International Institute of Refrigeration*, formed through the *National Research Council*.

and humidity control. From 1951-1954 he served in the capacity of Director of Research with the Borg-Warner Corp. and was in charge of the Central Research Laboratory. He became associated with the Technicolor Corp. in 1954 designing and doing research on photography and graphic arts. In 1957 he joined the Crane Co.

Dr. Nelles became a member of the Society in March, 1958.

He also holds membership in *ASME, SAE*, and *IAS, ASTE, American Ceramic Society, American Chemical Society, Academy of TV Arts and Sciences, Instrument Society of America, AIME*, and *ASM*.

HERBERT B. NOTTAGE, a native of Oakland, Calif., is a research specialist at the Engineering Research Laboratory of the Lockheed Aircraft Corp., Burbank, Calif.

A graduate of the University of California, Dr. Nottage received his B.S. in mechanical engineering with honors in 1937 and his M.S. in 1939. During this period he worked for some time as a research assistant in the Department of Mechanical Engineering on the cooperative research studies on cooling towers sponsored by the ASHAE. Since this time he has obtained his Ph.D. from Case Institute of Technology.

From September 1939 to August 1941 he was instructor in mechanical engineering

R. C. Jordan
Minneapolis, Minn.

Maurice Nelles
Chicago, Ill.

H. B. Nottage
Burbank, Calif.

P. H. Yeomans
Philadelphia, Pa.

Research, is serving as its vice chairman and as a member of its Research Executive Committee. He has been a member of numerous Research Technical Advisory Committees — Heat Pump since its inception in 1948, serving as chairman during the first 4 years; Instruments in 1944-45; Evaporative Cooling from 1953 through 1955; Cooling Load from 1947 to 1955, serving as its vice chairman in 1954; chairman, Solar Energy Utilization from 1955 to date; vice chairman of Heat Transfer through Fenestration, 1957.

He was elected vice president of the Minnesota Chapter in 1948, president in 1949, and a member of its board of governors in 1950.

A fellow of *ASRE* and a Council member since 1944, Professor Jordan has held

MAURICE NELLES, vice president in charge of Engineering with the Crane Co., Chicago, received his Ph.D. in Engineering in 1932 from Harvard University. Previous to this, he had merited both an A.B. degree and an M.A. degree from the University of South Dakota. He also has been honored with a D.Sc. degree from the latter University.

From 1940-46 Dr. Nelles was senior research engineer and staff assistant with the Lockheed Aircraft Corp. where he did pioneering work on aircraft air conditioning. In 1947 he became Professor of Aero Engineering at the University of Southern California. Dr. Nelles spent the next year as Director of the Engineering Experiment Station at Pennsylvania State University where he experimented with heat transfer

at the Illinois Institute of Technology, Chicago, and in August 1941, he joined the research and development engineering staff of Pratt and Whitney Aircraft, East Hartford, Conn. During the period from 1945 to 1952, Dr. Nottage was research associate at the ASHAE Research Laboratory, Cleveland, Ohio. In 1952 he became project manager with the Propulsion Research Corp. In 1957 Dr. Nottage became associated with Lockheed Aircraft Corp.

A member of the Society since 1943, he was a member of the Nominating Committee in 1956, and in 1957 was named first alternate on that committee for Region 4. For the past 2 years he has served on the ASHAE Standards subcommittee on Guidance for Members in Preparation of Local Codes. Dr. Nottage has also served on

many of the Research Technical Advisory Committees — Cooling Towers, Evaporative Condensers and Spray Ponds from 1940-42, serving as its chairman in 1943; from 1953-55 on Cooling Load; Air Distribution since 1953; and Thermal Circuits since 1955.

Dr. Nottage has been affiliated with the Southern California Chapter, serving as a member of its board of governors 1957-58. He also served as chairman of its Codes and Standards from 1954 to date.

Dr. Nottage also holds membership in *ASME, AIChE,* Tau Beta Pi, and F & AM; he is a former member of the Los Angeles Chamber of Commerce. He is listed in the latest edition of *American Men of Science.*

Author of a number of research papers published in the Society's JOURNAL and TRANSACTIONS, he has contributed also to THE GUIDE, *ASME Transactions,* and *Industrial Engineering Chemistry.*

Since 1954 he has lectured in engineering at the University of California at Los Angeles.

PAUL H. YEOMANS, consulting engineer, Philadelphia, was born in Unionville, N.Y. He received a Bachelor of Science degree in Mechanical Engineering from the University of Pennsylvania in 1920. In the early years after graduation, he worked as a heating engineer for Warren Webster & Co., Camden, N.J., and as a sales engineer for John J. Nesbitt, Inc., Holmesburg, Pa.

Mr. Yeomans taught heating and ventilating, and physics in Philadelphia schools for a few years prior to joining Socony Burner Corp., New York, N. Y. in 1926. Two years later, he became associated with Armstrong Cork Co., Lancaster, Pa., and was responsible for engineering in connection with heating, ventilating and air-conditioning problems for all of their domestic plants. In 1944 he became a sales engineer for Carrier Corporation, Philadelphia. Mr. Yeomans left Carrier Corporation in 1946 to begin practice as a consulting engineer. His firm was known as Walker-Yeomans Associates, Inc., from 1950 to 1956, when he severed this connection and again opened his own office for private practice. He is registered to practice in Pennsylvania, New Jersey, New York, Delaware and Maryland.

A member of the Society since 1944, Mr. Yeomans completed an unexpired term on the Committee on Research during 1956-57. He served as a member of some of the Technical Advisory Committees — Cooling Load in 1955, on the Heating and Air Conditioning Loads in 1956, and as its vice chairman in 1957.

Mr. Yeomans was president of the Philadelphia Chapter last year. He previously served that chapter as a member of the board of governors, secretary, treasurer, second and first vice presidents in the consecutive years from 1952 to 1956. In 1954, 1956 and 1957 he was an alternate member of the Chapters Conference Committee.

He was a member of the American Business Club of Lancaster, and is now a member of the Engineers Club of Philadelphia, the *Engineering and Technical Societies Council,* Kiwanis Club of Philadelphia, and the Philadelphia Chapter of the *Pennsylvania Society of Professional Engineers.*

International Congress Meets in Brussels

The Society occupied an important place in the program of the International Congress for Heating and Air Conditioning held in Brussels September 22-26.

The Congress was organized under the direction of its President-General Henri B. Marcq, Brussels, Belgium, ASHAE member. Mr. Marcq is also President of the *Technical Association of the Heating, Ventilating and Allied Industries* (A.T.I.C., Belgium). H. A. Roba, Brussels, Belgium, also an ASHAE member, is Secretary General of the Congress.

B. H. Jennings
Cleveland, Ohio

Carl F. Kayan
New York, N. Y.

Tying in with the theme of the Brussels Fair — *A Balanced World For a More Human World* — the Congress was planned to inventory the contributions of heating and air conditioning toward a better balanced method of living.

Officially representing the Society were C. F. Kayan, New York, N. Y., and B. H. Jennings, Cleveland, Ohio, director of research.

Members of the Society who served on the Patrons Committee for the Congress were A. Beaurrienne, Paris, France, who was president of the last International Congress held in Brussels in 1930; G. S. K. Benham, London, England, President of *IHVE* of Great Britain; w. Gyzi, Baar, Switzerland, president of the Swiss Central Heating organization; and Andre Missenard, St. Quentin, (AISNE) France, president of the Scientific Committee of the Heating and Ventilating Industry, France.

The working program of the Congress took place during 4 sessions of which 2 continued throughout a whole day while the other 2 were afternoon sessions. Of the 21 papers included on the printed program 5 were authored by ASHAE members.

Mr. Jennings' paper at the session on *Heating and Air Conditioning in Their Relationship to Man* was presented under the title *A Critique of Current Knowledge and Research Relative to Human Comfort and Environment.* At the same session G. V. Parmelee, Dhahran, Saudi Arabia, ASHAE member, formerly on the staff of the Research Laboratory, and now staff engineer with The Arabian American Oil Co., presented a paper entitled *Air-Conditioning Requirement in Remote Desert Area.* At the same session papers were also presented by Mr. Missenard, and by Dirk van Zuilen, The Hague, Netherlands, director of the *Health Technical Institute,* Netherlands, and an ASHAE member.

At other sessions papers by Society members were presented by Roger Cadiergues, Paris, France, on radiant panel emission, and by Walter Sennhauser, Zurich, Switzerland, on cases of corrosion in heating installations and how they were prevented.

In addition to the technical sessions the Congress also included inspection trips and a closing banquet.

TRANSACTIONS OF SOLAR ENERGY CONFERENCE

Transactions of the Conference on the *Use of Solar Energy—the Scientific Basis* —are now available. These Transactions contain some 80 papers which were presented during the course of the Conference held in Tucson, Ariz., October 31—November 1, 1955 under the sponsorship of the University of Arizona, Stanford Research Institute, *Association for Applied Solar Energy.* It attracted a great deal of attention and a large attendance including most of the world authorities on the subject. Many of these same authorities contributed papers.

The Transactions are in the form of six 8½ x 11 in. mimeographed pamphlets and arranged in 5 volumes under the following titles: Vol. I—The Available Energy Measurement of The Radiation; Vol. II—Thermal Processes, Part I, Sections A and B; Vol. III—Thermal Processes, Part II; Vol. IV—Photochemical Processes; Vol. V—Electrical Processes.

The whole set of 5 volumes is available at a price of $12.50 from the University of Arizona Press, Tucson, Ariz.

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Bedford to Speak on Comfort Studies

Thomas Bedford, London, England, will visit the U. S. during January and February 1959. He has accepted an invitation while here, to deliver a paper at the opening session of the 65th Annual Meeting of the Society in Philadelphia on January 26th with the title *Researches on Heating and Ventilation in Relation to Human Comfort.* Dr. Bedford plans to stay in Philadelphia throughout the period of the meeting and Exposition.

At present, Dr. Bedford is director, Medical Research Council's Environmental Hygiene Research Unit in London. He is also a special lecturer in Industrial Hygiene, London School of Hygiene and Tropical Medicine.

For nearly 40 years, Dr. Bedford has been engaged in studies connected with occupational health. He holds the degrees of both D.Sc. and Ph.D from the University of London. A prolific writer as well as a gifted research worker, Dr. Bedford is the author or co-author of numerous technical papers, reports and bulletins which have been published in England and in continental periodicals. His book entitled *Basic Principles of Ventilation and Heating* is well known in the United States. His studies of occupational health have ranged from miners in England to factory workers in India. He has looked into the use of heat measuring instruments and into the reactions of people to their air environment. He is perhaps best known in this country because of his work on the development of the *Equivalent Warmth Index* which index takes into account the radiant temperature of the environment as a factor in comfort reactions.

As a mark of recognition of his work, Dr. Bedford was awarded the French Gold Medal for the science of artificial climate in 1957.

Dr. Thomas Bedford
London, England

Following the close of the meeting and Exposition, Dr. Bedford will lecture at the Naval Air Development Center, Johnsville, Pa., the University of Pennsylvania, Philadelphia, the University of Minnesota, Minneapolis, at the University of Illinois, Urbana, and the Harvard School of Public Health, in Boston.

In his busy schedule before leaving for home around the middle of February, Dr. Bedford also has planned to visit the Society Research Laboratory in Cleveland for consultation on the comfort program there, and expects also to talk before the Illinois Chapter of the Society in Chicago.

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CANDIDATES FOR MEMBERSHIP

Listed here are the names of 65 men who are the candidates for membership or advancement in membership grade. Members are requested to assume their full share of responsibility of receiving these candidates into membership by advising the Executive Secretary before October 31, 1958, of any whose eligibility for membership is questioned. Unless such objection is made these candidates will be voted upon by the Council.

Note: **Advancement* †*Reinstatement*

California (*Region* 4)

BUCKLEY, K. E.*, Sales Engr., The Powers Regulator Co., San Francisco.

SMITH, H. L., Chief Engr., Burke & Co., Los Angeles.

District of Columbia (*Region* 5)

WILSON, R. L., Sales Engr., American Blower Division of American Standard, Washington.

Georgia (*Region* 5)

VESS, D. M.†, Supvsr.-Engr., Southern Bell Telephone & Telegraph Co., Atlanta.

Illinois (*Region* 2)

BIHLER, L. A., Mech. Engr., Sessions Engineering Co., Chicago.

JOYCE, M. J., Br. Mgr., Aitherm Mfg. Co., Chicago.

MADDEN, D. E., Vice Pres., A. W. Cash Valve Mfg. Corp., Decatur.

NICHOLLS, J. D., SR., Sales Engr., The Trane Co., Chicago.

NOWICKI, J. J., Mech. Engr., Advance Heating & Air Conditioning Corp., Chicago.

JOURNAL SECTION

PADEN, D. S., Sales Repr., Modine Mfg. Co., Chicago.

Illinois (*Region* 3)

FREDERIKSEN, J. A., Owner-Engr., Frederiksen Engineering, Moline.

Iowa (*Region* 3)

HASSELBALCH, R. J., Dist. Sales Mgr., Lennox Industries Inc., Des Moines.

Louisiana (*Region* 5)

NEVE, R. A., Sales Engr., The Trane Co., Baton Rouge.

Massachusetts (*Region* 1)

MABEE, I. H., Partner, J. M. Pettingell Associates, Belmont.

Michigan (*Region* 2)

MILLER, E. P., Sales Engr., Minneapolis-Honeywell Regulator Co., Detroit.

Missouri (*Region* 3)

JOHNS, C. M., Sales Engr., American Blower Division of American Standard, St. Louis.

OWENS, E. J., Sales Engr., Lennox Industries, Kansas City.

WARREN, R. L., Div. Engr., General Service Administration, Kansas City.

New Jersey (*Region* 1)

DALRYMPLE, J. M., Sales Engr., John L. Nesbitt, Inc., E. Orange.

D'AMATO, O. J., Mech. Engr., Stevens Engineering Co., Newark.

GATIK, NATHAN, Partner, Jersey State Plumbing & Heating Supply Co., Hackensack.

LEWIS, J. R., Vice Pres., Engrg. Sales, Walton Laboratories, Inc., Irvington.

New York (*Region* 1)

BALDWIN, C. W.†, A-C. Engr., Vinnell Co., Syracuse.

DAVIS, A. F., Tech. Asst.-Constr. & Engrg., International Business Machines Corp., White Plains.

GARCIA, ANGEL, Field Engr., Carrier Corporation, East Syracuse.

GOLDBERG, NORMAN,*, Group Chief, Voorhees Walker Smith & Smith, New York.

HELLER, R. H., Estimator, Burns Bros. Plumbers, Inc., Syracuse.

JUSTIN, J. K.*, Mgr., Burgess-Manning Ceiling Div., Jacobson & Co., Inc., New York.

MOORE, R. L., Group Leader-Fan Coil Equipment, Carrier Corporation, Syracuse.

PEARCE, R. J., Sales Engr., Surface Combustion Corp., New York.

PINTER, J. L.*, Sales Engr., Spencer Heater, New York.

REAPE, ROBERT, Designer, Albert Fentzlaff, Inc., New York.

Attention!!

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Moved or Moving?

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ASHAE Headquarters
62 Worth St.
New York 13, N. Y.

JOURNAL SECTION

RINDNER, DANIEL, Factory Repr., Fitzgibbons Boiler Co., Inc., New York.

TERRY, ROBERT, Designer, Albert Fentzlaff, Inc., New York.

Ohio (*Region* 2)

MOLLEBAN, W. G., Engr.-Mech. Sect. Gen. Engrg. Dept., Cincinnati Gas & Electric Co., Cincinnati.

NICKOLS, W. R., Vice Pres., Fab-Pipe, Inc., Columbus.

SWAIN, E. G.*, Asst. Chief Appl. Engr., C. A. Olsen Mfg. Co., Elyria.

Oklahoma (*Region* 6)

DUNN, R. P., Sales Tech., Advance Air Conditioning Co., Tulsa.

Pennsylvania (*Region* 1)

HEFFLER, MARTIN, Owner, Fuel Control Engineers, Philadelphia.

JACOB, R. O., Engr. in Charge, Building Service Group, Philadelphia Electric Co., Philadelphia.

MUSCHLITZ, W. L., Assoc. Prof. of Engrg. Research, Supervisor — Power Plant Advisory Service, Pennsylvania State University, University Park.

Rhode Island (*Region* 1)

BUCCI, DOMENIC, JR., Designer, Buerkel Co., Inc., Providence.

GUILLEMETTE, J. D., Partner & Sr. Engr., J. D. Guillemette & Assocs., Providence.

South Carolina (*Region* 5)

DILL, R. J., Vice Pres., Super Supply Co., Inc., Greenville.

Texas (*Region* 6)

HATTON, J. R., A-C. Consultant, Central Power & Light Co., Alice.

Virginia (*Region* 5)

BLAIR, H. A.*, Gen. Service Mgr., Westinghouse Electric Corp., Air Cond. Div., Staunton.

HARPER, J. E., Tech. Repr., Worthington Corp., Norfolk.

Washington (*Region* 4)

HAGER, H. R., Sales Engr., Larry Harrington Co., Inc., Seattle.

Wisconsin (*Region* 2)

STEVENS, C. M., Sales Repr., Buffalo Forge Co., Milwaukee.

Canada (*Region* 7)

BELANGER, EMILE, Pres., Charles Belanger & Fils, Ltd., Montreal, Que.

JACKSON, A. H., Sales Engr., Gordon Latham, Ltd., Vancouver, B. C.

JAREMKO, W. W., Sales Engr., Dunham-Bush (Canada) Ltd., Hamilton, Ontario.

MACPHERSON, R. M., Johnson Controls, Ltd., Ottawa, Ont.

MCDONALD, K. S., Sales Mgr., Electric Power Equipment, Ltd., Vancouver, B.C.

MORTON, H. J. F., Htg. Draftsman, Crane, Ltd., Ottawa, Ont.

OAKES, A. W., Divisional Engr., Canadian Ice Machine Co., Ottawa, Ont.

OUELLETTE, R. A., Designer, Associated Designers & Inspectors, Fredericton, N. B.

RABJOHN, R. W., Sales Engr., Trane Co., (Canada) Ltd., Ottawa, Ont.

ST-DENIS, JACQUES, Design Engr., Pageau & Morel, Montreal, Que.

Arabia

SALEM, M. A., Design Engr., Electricity Dept. A. C. H. & V. Section, Kuwait.

Australia

HODGE, H. B.*, Dir. & Mgr., Gardner & Naylor P/L, Hawthorn, Melbourne E. 2, Victoria.

WILSON, L. R., Mgr., Dir., Burnotherm Pty., Ltd., Coburg, Melbourne, Victoria.

England

WARD, C. V.†, Managing Dir., Atmospheric Control, Ltd., Manchester.

South America

SILVA, R. B., Chief Engr., Byington & Cia, Sao Paulo, Brazil.

Southern Rhodesia

REX, R. H., Sr. Cons., A-C. Dept., Sanco Consolidated Ltd., Salisbury.

From 1900 to 1904 he was in charge of heating and ventilating design of layout work for the C. H. Bradley, Jr. & Co., Pittsburgh. In 1904 he organized the Federal Engineering Co., where he was in charge of engineering in design, installation and operation of steam, gas, water and air heating systems. He later became chief engineer for the company.

Mr. Reed was also a Life Member of *ASME*. He belonged to the *National Association of Power Engineers*, the *Engineers Society of Western Pennsylvania*, and is a Registered Professional Engineer in the State of Pennsylvania.

OBITUARIES

SIMON Z. BURK
Norfolk, Va.

Simon Z. Burk, chief of the mechanical section, Corps of Engineers, Department of Army, Fort Norfolk, Norfolk, Va. died July 18 at the age of 40. Mr. Burk joined the Society in 1951.

Mr. Burk was graduated in 1940 from Mississippi State College. Following this, he became associated with the Tennessee Valley Authority until 1945. In 1946 Mr. Burk joined the Corps of Engineers.

His widow, Mary S. Burk, resides in Norfolk.

RAY L. SPITZLEY
Detroit, Mich.

Ray L. Spitzley, founder of the R. L. Spitzley Heating Co., Detroit, and Life Member of Society, died August 24 in Del Ray Beach, Fla., his home since his retirement in 1952.

Mr. Spitzley graduated from the University of Michigan in 1911. He worked in various phases of construction, and in 1918, opened the R. L. Spitzley Heating Co.

A member of the Society since 1919, Mr. Spitzley was also a past president of the *Heating, Piping and Air Conditioning Contractors National Association*.

Surviving are his wife, two sons, a brother, and six grandchildren.

VAN A. REED, JR.
Elizabeth, Pa.

Van A. Reed, Jr., secretary of the Federal Engineering Co., was elected to Life Membership in 1950. He was a member of the Society since 1930.

Mr. Reed was born in Pittsburgh, Pa., he received his preparatory education in Elizabeth, Pa., and attended Armour Institute.

LESLIE S. GILBERT
Dallas, Tex.

Leslie S. Gilbert, a member of the Society since 1937, died August 17 at his home in Dallas, Tex.

Mr. Gilbert was graduated from Montana State University and was president of the Gilbert Engineering Co., Inc. which he founded in 1932.

He is survived by his wife, a daughter, Shirley, his mother, and a sister.

PETER J. KEEGAN
Flushing, N. Y.

Peter J. Keegan, field engineer, American Air Filter Co., Inc., died June 11. Mr. Keegan was employed by the American Air Filter Co. since 1937. During this time he did a great deal of work on the installation of electronic air filters.

Mr. Keegan joined the Society in 1949.

ANDREW W. KNECHT, III
New York, N. Y.

Andrew W. Knecht, III, a Society member since 1957, died recently at the age of 26. Mr. Knecht was graduated from Lehigh University with a Bachelor of Science degree in mechanical engineering in 1954. While attending Lehigh he worked for L. K. Comstock as estimator and job engineer. After graduation, he became associated with Seelye, Stevenson, Value and Knecht as a design engineer.

His father, A. Wilson Knecht, is also a member of the Society.

ROBERT E. SINCLAIR
Portland, Ore.

Robert E. Sinclair, assistant division manager with Pacific Power and Light Co., Portland, Ore. died as a result of an accident on July 19. His wife was also fatally injured in the accident.

Mr. Sinclair was born at Kendrick, Ia., and attended Cornell University where he studied Electrical Engineering.

He became associated with the Pacific Power & Light Co. in 1931. Except for a brief period in 1946-47 as assistant to the vice president of Northwestern Electric Co., he remained with Pacific Power & Light Co. until his death.

Mr. and Mrs. Sinclair are survived by three sons, Donald, David and Robert.

Presidents and Secretaries of Society Chapters and Branches

The Society has chartered 72 Chapters, 1 Overseas Branch, and 6 Student Branches. These organizations elect their own officers and governing boards. Following is a list giving the name and address of the president and secretary of each of these groups.

Date indicates year organized; and address and no city shown signifies same city as headquarters; numeral in parentheses indicates zone.

ARIZONA

Arizona: 1953. Hdqrs., Phoenix. Meets, 1st Mon. PRES, F. W. Gabbard, 111 East 14th St., Tempe. SECY, J. R. Hight, 6145 N. 31st Dr.

ARKANSAS

Arkansas: 1952. Hdqrs., Little Rock. Meets, 3rd Tues. PRES, K. A. Pettit, 904 Wallace Bldg. SECY, O. L. McCallister, 6 Belmont Dr.

CALIFORNIA

Golden Gate: 1937. Hdqrs., San Francisco. Meets, 1st Thurs. PRES, J. B. Smith, 1129 Folsom St. SECY, R. C. Pribuss, 718 Natoma.

Sacramento Valley: 1952. Hdqrs., Sacramento. Meets, 1st Wed. PRES, J. A. White, 5210 Esmeralda St. SECY, W. B. Landor, 1930 Rockbridge Rd.

Southern California: 1930. Hdqrs., Los Angeles. Meets, 1st Tues. PRES, A. Z. Levine, 1127 Crenshaw Blvd. (19). SECY, A. Zimmerman, 8304 Beverly Blvd. (48).

COLORADO

Rocky Mountain: 1944. Hdqrs., Denver. Meets, 1st Wed. PRES, J. R. Wilson, 240 Kalamath St. (23). SECY, R. J. Walker, 4505 Balsam, Wheat Ridge.

CONNECTICUT

Connecticut: 1940. Hdqrs., New Haven. Meets, 3rd Thurs. PRES, R. B. Cahoon, 150 James St. (13). SECY, E. M. Johnson, 1007 Farmington Ave. W. Hartford.

DISTRICT OF COLUMBIA

Washington, D.C.: 1935. Hdqrs., Washington, D.C. Meets, 2nd Wed. PRES, H. W. Rush, 116 Southwood Ave., Silver Spring, Md. SECY, L. D. Pain, 102-B Ames Rd., Silver Spring, Md.

FLORIDA

Jacksonville: 1957. Hdqrs., Jacksonville. Meets, 1st Tues. PRES, J. R. Spence, 802 Kipp Ave. (7). SECY, W. D. Minick, 1013 Eighth St., N. Jacksonville Beach.

GEORGIA

Atlanta: 1937. Hdqrs., Atlanta. Meets, 2nd Mon. PRES, J. S. Edgar, 2015 Peachtree Rd., N. W. SECY, B. W. Dean, 3075 Piedmont Rd., N. E. (5).

Savannah: 1958. Hdqrs., Savannah. PRES, E. F. Young, 2805 Aimar Ave. Bonna Bella Pt. SECY, R. L. Hume, P. O. Box 1788.

ILLINOIS

Illinois: 1906. Hdqrs., Chicago. Meets, 2nd Mon. PRES, H. Kreisman, 117 N. Desplaines St. (6). SECY, J. C. Scott, 6655 N. Ridge Blvd. (26).

Illinois-Iowa: 1956. Hdqrs., Moline. Meets, 3rd Mon. PRES, D. H. Ninow, 1824 Third Ave. SECY, R. F. Demange, 307 16th St.

INDIANA

Indiana: 1943. Hdqrs., Indianapolis. Meets, 4th Tues. PRES, W. F. Currise, 619 Architects & Builders Bldg. (4). SECY, A. B. Keller, 4320 Glencairn Lane (18).

IOWA

Iowa: 1940. Hdqrs., Des Moines. Meets, 2nd Tues. PRES, R. T. Howard, Jr., 220 Davidson Bldg. SECY, J. R. Bain, 1911 Ingersoll.

KANSAS

Kansas: 1951. Hdqrs., Wichita. Meets, Tues. after 1st Mon. PRES, G. L. Oswald, 1117 E. Waterman (7). SECY, R. B. Peugh, 307½ Laura (1).

KENTUCKY

Bluegrass: 1954. Hdqrs., Louisville. Meets, 2nd Mon. PRES, H. L. Carr, 304 W. Liberty St. (2). SECY, H. J. Bohannon, Jr., 3005 Ralph Ave. (16).

LOUISIANA

Baton Rouge: 1955. Hdqrs., Baton Rouge. Meets, 3rd Wed. PRES, W. J. LeBlanc, 3185 Government St. SECY, R. F. Dupuy, 5223 Hermitage Dr.

Delta: 1939. Hdqrs., New Orleans. Meets, 3rd Tues. PRES, R. K. Goode, 4052 Thalia St. SECY, E. H. Sanford 472 Bellaire Dr.

Shreveport: 1948. Hdqrs., Shreveport. Meets, 3rd Thurs. PRES, L. E. Kneipp, P. O. Box 6092. SECY, J. J. Guth, Jr., La. Bank Bldg., Rm. 1.

MARYLAND

Baltimore: 1949. Hdqrs., Baltimore. Meets, 3rd. Wed. PRES, F. M. Hewitt, 33 East 21st St. (18). SECY, C. H. Higdon, Jr., 709 Scarlett Dr., Towson (4).

MASSACHUSETTS

Massachusetts: 1912. Hdqrs., Boston. Meets, 3rd Tues. PRES, R. F. Curry, 34 Sheridan Rd., Wellesley Hills (82). SECY, R. B. Stevens, 31 Harvard St., Brookline.

Western Massachusetts: 1955. Hdqrs., Springfield. PRES, C. R. Munn, 15 Page Blvd. (4). SECY, K. W. Maki, 192 Williams St. Longmeadow (6).

MICHIGAN

Michigan: 1916. Hdqrs., Detroit. Meets, 1st Mon. after 10th of month. PRES, K. J. Wagoner, 15370 Schaefer Hwy. (27). SECY, J. G. Black, Jr., 1200 W. Fort St. (26).

Western Michigan: 1931. Hdqrs., Grand Rapids. Meets, 2nd Mon. PRES, R. J. Waalkes, 500 E. Eighth St., Holland. SECY, G. L. Jepson, 301 Henrietta St., Kalamazoo.

Society Organization Personnel

General Committees: The By-Laws provide for 9 such committees. The latest list appears in the July 1958 issue on page 148

Research Committees: The research program is under the guidance of the Committee on Research — a General Committee. The Committee on Research appoints Technical Advisory Committees as needed. The 1958 personnel appears in the June 1958 JOURNAL SECTION on page 174

Special Committees: At present there are 9 of these committees. The latest listing appears in the July 1958 issue on page 148

Standards Committee: Its subcommittees and its representatives appear in the August 1958 issue on page 166

Nominating Committee: This committee's membership is fixed by the By-Laws. The latest listing appears in the July 1958 issue on page 148

Society Regional Organization: The 1958 listing of the names of the Regional Directors and of the members of the Chapters Regional Committees was published in the May 1958 issue on page 194

Society Chapters and Branches: The Society has chartered 72 Chapters, 1 Overseas Branch, and 6 Student Branches. These groups elect their officers and governing boards. A list of the presidents and secretaries appears in this issue (see above and on the following page).

JOURNAL SECTION

MINNESOTA

Minnesota: 1918. Hdqrs., Minneapolis. Meets 1st Mon. PRES, J. H. Jester, 621 E. Hennepin Ave. SECY, J. W. McNamara, 850 Cromwell Ave., St. Paul (14).

MISSISSIPPI

Mississippi: 1953. Hdqrs., Jackson. Meets, 4th Mon. PRES, D. F. Ingram, 408 W. Fortification St. SECY, W. D. Fortner, P. O. Box 1138.

MISSOURI

Kansas City: 1917. Hdqrs., Kansas City. Meets, 1st Mon. PRES, S. C. McCann, 210 W. 10th St. (5). SECY, L. A. Heaven, 1529 Wyandotte (8).

St. Louis: 1918. Hdqrs., St. Louis. Meets, 2nd Wed. PRES, J. J. Blackmore, 4233 Chouteau Ave (10). SECY, J. B. Killebrew, 8640 Pardee Lane (23).

NEBRASKA

Nebraska: 1940. Hdqrs., Omaha. Meets, 2nd Tues. PRES, E. N. Seifer, 1824 North 53rd St. SECY, W. L. Ryan, 2651 St. Mary's Ave.

NEW JERSEY

North Jersey: 1952. Hdqrs., Newark. Meets, 2nd Tues. PRES, S. H. Nitzberg, P. O. Box 157, Wood Ridge. SECY, C. E. Parmelee, 85 Norwood Ave., Montclair.

NEW MEXICO

New Mexico: 1954. Hdqrs., Albuquerque. Meets, 3rd Tues. PRES, F. H. Bridgers, 213 Truman St., N.E. SECY, R. P. Lee, 114 Granite Ave., N.W.

NEW YORK

Central New York: 1944. Hdqrs., Syracuse. Meets 3rd Wed. PRES, E. L. Moyer, R.D. 2, Jamesville. SECY, R. A. Barr, 139 Dolshire Dr., N. Syracuse.

Empire State Capital: 1951. Hdqrs., Albany. Meets, 2nd Wed. PRES, E. J. Mahoney, 45 Colvin Ave. SECY, E. E. Phillips, 1206 Albany St., Schenectady.

Long Island: 1957. Hdqrs., Garden City. Meets, 2nd Mon. PRES, H. J. Campbell, Jr., 288 Old Country Rd., Mineola. SECY, J. L. Page, 41 W. 22nd St., Huntington Station.

New York: 1911. Hdqrs., New York. Meets, 3rd Mon. PRES, W. J. Olvany, 100 Charles St. (14). SECY, S. R. Apt, 36-39 205th St., Bayside (61).

Western New York: 1919. Hdqrs., Buffalo. Meets, 2nd Mon. PRES, J. P. Guerra, 34 E. Depew Ave. (14). SECY, F. R. Collins, Jr., 79 Meadow Stream Dr., Snyder (21).

NORTH CAROLINA

Northern Piedmont: 1952. Hdqrs., Greensboro. Meets, 2nd or 3rd. Fri. PRES, G. B. Rottman, 233½ N. Greene. SECY, E. A. Stroupe, Jr., P.O. Box 3135.

Southern Piedmont: 1952. Hdqrs., Charlotte. Meets, last Mon. PRES, J. R. Clark, P. O. Box 1755 (1). SECY, E. V. Overcash, P. O. Box 2155.

OHIO

Central Ohio: 1944. Hdqrs., Columbus. Meets, 3rd Mon. PRES, R. C. Liebert, 500 Dana Ave. (23). SECY, E. T. Stluka, 133 De Santis Dr. (14).

Cincinnati: 1932. Hdqrs., Cincinnati. Meets, 1st Tues. PRES, C. P. Krantz, 7612 Reinhold Dr. (37). SECY, W. H. Rieger, 1423 E. McMillan (6).

Miami Valley: 1950. Hdqrs., Dayton. Meets, 1st Wed. PRES, R. B. Walcott, 2340 E. River Rd. (39). SECY, F. H. Doench, 357 West First St. (2).

Northern Ohio: 1916. Hdqrs., Cleveland. Meets, 2nd Mon. PRES, R. A. Urban, 1740 E. 12th St. (14). SECY, B. A. Schwirtz, 2036 E. 22nd St. (15).

Toledo: 1954. Hdqrs., Toledo. Meets, 1st Mon. PRES, D. L. Wilson, 2446 Sylvania Ave. (13). SECY, E. J. Katafiasz, 1133 Radcliffe Dr. (9).

OKLAHOMA

Northeastern Oklahoma: 1948. Hdqrs., Tulsa. Meets, 2nd Tues. PRES, J. C. Chase, 3141 East 15th St. SECY, J. E. Tumilty, 1135 East 38th St. (5).

Oklahoma: 1935. Hdqrs., Oklahoma City. Meets, 2nd Mon. PRES, W. R. Johnson, 120 E. Main. SECY, T. L. Robinson, 313 N.W. Fourth, Suite 5.

OREGON

Oregon: 1939. Hdqrs., Portland. Meets, Thurs. after 1st Tues. PRES, W. B. Hayes, 6446 N.E. 24 (11). SECY, W. S. Cooper, 445 Pittock Block.

PENNSYLVANIA

Johnstown: 1957. Hdqrs., Johnstown. PRES, K. O. Schleitner, 221 Central Ave. SECY, J. K. Thornton, R.D. 4, Box 230.

Philadelphia: 1916. Hdqrs., Philadelphia. Meets, 2nd Thurs. PRES, C. J. Forve, Parkwood Manor Apts., Apt. B-202, State Rd. & Penarth Ave., Upper Darby. SECY, H. N. Teuber, 17th & Federal Sts. Camden (5).

Pittsburgh: 1919. Hdqrs., Pittsburgh. Meets, 3rd Mon. PRES. E. J. Busch, 9387 Cromwell Dr. (37). SECY. G. E. Smetak, 2793 Noblestown Rd. (5).

SOUTH CAROLINA

South Carolina: 1954. Hdqrs., Columbia. Meets, 3rd Mon. PRES, H. J. Haar, Jr., Garner Rd., Rt. 6, Spartanburg. SECY, T. O. Curlee, Jr., 209 E. Stone Ave., Greenville.

TENNESSEE

Memphis: 1944. Hdqrs., Memphis. Meets, 3rd Mon. PRES, G. B. Ramsey, III, 157 Neil St. SECY, A. L. Barksdale, 1530 Madison Ave.

TEXAS

Austin: 1956. Hdqrs., Austin. Meets, 3rd Thurs. PRES, J. L. Rea, Jr., Box 5206. SECY, B. J. Barnhart, 711 W. St. Johns (5).

El Paso: 1956. Hdqrs., El Paso. Meets, 3rd Mon. PRES, W. A. Byars, Jr., 937 N. Clark Rd. SECY, J. H. Brooks, 4028 Hamilton St.

Fort Worth: 1957. Hdqrs., Fort Worth. Meets, 3rd Wed. PRES, T. B. Romine, Jr., 3 Wofford Bldg., 2816 Morton. SECY, C. L. Zahn, 2509 W. Berry St. (9).

North Texas: 1938. Hdqrs., Dallas. Meets, 3rd Mon. PRES, R. Zumwalt, 929 Mercantile Securities Bldg. (1). SECY, O. H. Mehl, 6915 Lavendale Ave. (30).

South Texas: 1938. Hdqrs., Houston. Meets, 3rd Fri. PRES, E. B. Appling, 1116 Hawthorne (6). SECY, H. G. McKee, 2425 South Blvd. (6).

Southwest Texas: 1946. Hdqrs., San Antonio. Meets 3rd Tues. PRES, J. G. Ford, 447 W. Hildebrand. SECY, E. E. Cravens, 722 W. Hildebrand (12).

West Texas: 1953. Hdqrs., Lubbock. Meets, 1st Tues. PRES, W. R. Anthony, 902 East 34th St. SECY, R. L. Mason, 2604 28th St.

UTAH

Utah: 1944. Hdqrs., Salt Lake City. Meets, 3rd Thurs. PRES, L. K. Irvine, 333 W. First, S., Box 2398 (10). SECY, V. Q. Tregeagle, 303 Dooly Bldg.

VIRGINIA

Virginia: 1946. Hdqrs., Norfolk. Meets, 3rd Wed. PRES, D. L. Gusler, 208 Midtown Bldg. (5). SECY, R. F. Fox, 4701 Colley Ave. (8).

WASHINGTON

Inland Empire: 1950. Hdqrs., Spokane. Meets, 1st Mon. PRES, R. D. Nevers, P.O. Box 5026. SECY, R. B. Campbell, 917 W. Mallon.

Puget Sound (Formerly Pacific Northwest): 1928 Hdqrs., Seattle. Meets, 2nd Tues. PRES, M. W. McKinstry, 4017 McGilvra St. (2). SECY, K. G. Massart, 7129 44th, S.W. (6).

WISCONSIN

Wisconsin: 1922. Hdqrs., Milwaukee. Meets, 3rd Mon. PRES, R. D. Rodwell, 152 Wisconsin Ave. (3). SECY, R. I. Anderson, 8214 W. Portland Ave.

CANADA

British Columbia: 1952. Hdqrs., Vancouver. Meets, 2nd Wed. PRES, S. W. Welsh, 733 Beatty St. SECY, D. B. Leaney, 1690 W. Broadway (9).

Chapitre de la Ville de Quebec: 1956. Hdqrs., Quebec, P.Q. PRES, M. Paquet, 20 St. Jean St., Rm. 205 (4). SECY, F. L'Anglais, 605 Cote Ross (10).

Manitoba: 1935. Hdqrs., Winnipeg. Meets, 4th Thurs. PRES, D. S. Swain, 303 New Hargrave Bldg. (2). SECY, H. R. Skinner, 773 Sentenial St. (9).

Montreal: 1926. Hdqrs., Montreal. Meets, 3rd Mon. PRES, A. de Breyne, 307 Merton Ave., St. Lambert (23). SECY, W. U. Robinson, 415 Richmond St. (3).

Northern Alberta: 1956. Hdqrs., Edmonton. Meets, 3rd Wed. PRES, E. K. Cumming, 10249-104th St. SECY, G. N. Campbell, 10124 104th St.

Ontario: 1922. Hdqrs., Toronto. Meets, 1st Mon. PRES, J. Thompson, 620 University Ave. (2). SECY, H. R. Roth, 57 Bloor St., W. (5).

Ottawa Valley: 1952. Hdqrs., Ottawa. Meets, 3rd Tues. PRES, J. Klassen, 454, Slater St., (4). SECY, C. N. Kirby 465, Gilmoor St.

Southern Alberta: 1958. Hdqrs., Calgary. PRES, H. W. Klassen, 815 Sixth St., W. SECY, P. M. Meis, 102—58th Ave., SW.

OVERSEAS BRANCH

Switzerland: 1952. Hdqrs., Zurich. PRES, A. Eigenmann, Seestr. 105 (2). SECY, H. Kamm, Spitalgasse 30, Bern.

STUDENT BRANCHES

North Carolina State College: 1948. Faculty Adviser: Prof. R. B. Knight, M. E. Dept., Raleigh, N. C.

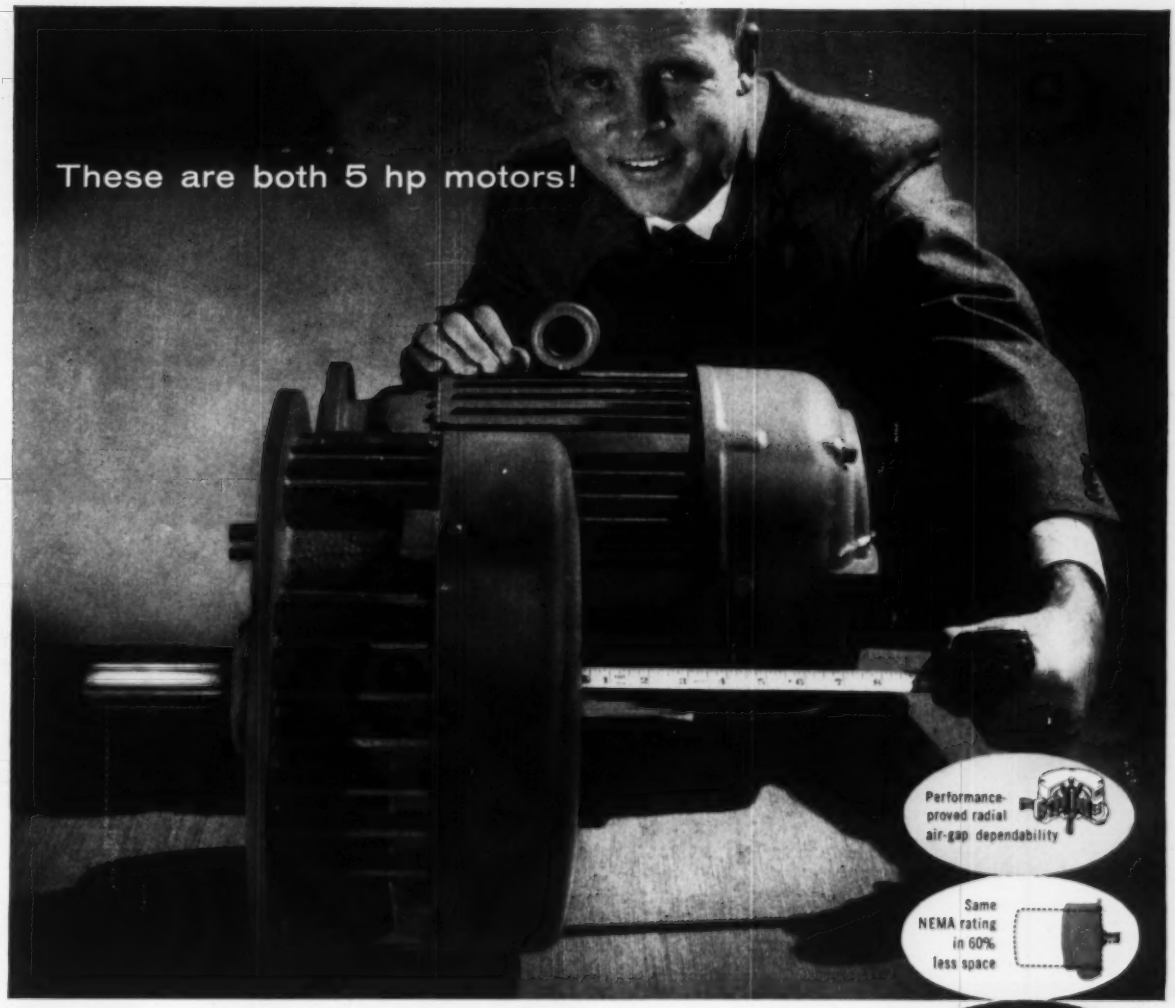
Oregon State College: 1949. Faculty Adviser: Prof. G. E. Thornburgh, M. E. Dept., Corvallis, Ore.

Purdue University: 1948. Faculty Adviser: Prof. F. B. Morse, M. E. Dept., West Lafayette, Ind.

Texas A. & M. College: 1946. Faculty Adviser: Prof. L. S. O'Bannon, M. E. Dept., College Station, Tex.

University of Detroit: 1949. Faculty Adviser: Prof. J. B. Olivieri, M. E. Dept., Detroit, Mich.

University of Toronto: 1951. Faculty Adviser: Prof. F. G. Ewens, M. E. Dept., Toronto, Ont., Canada.



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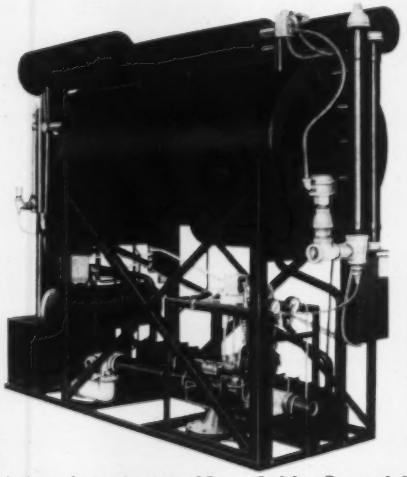

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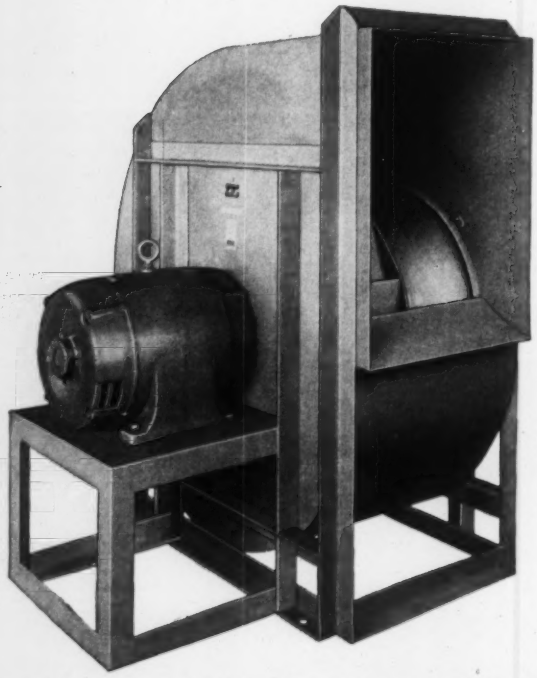

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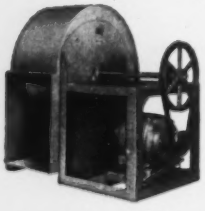

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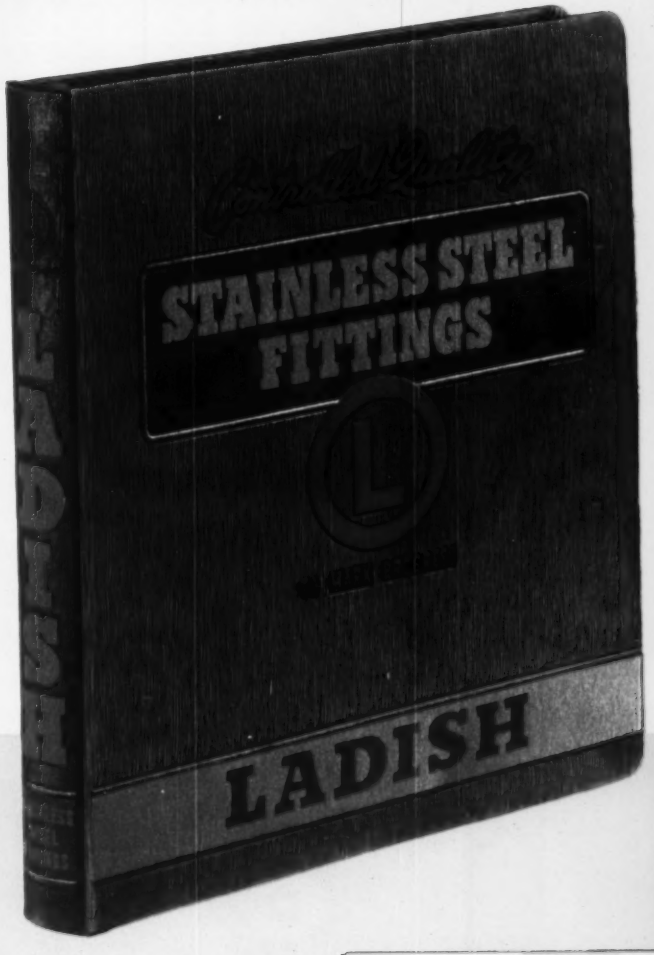

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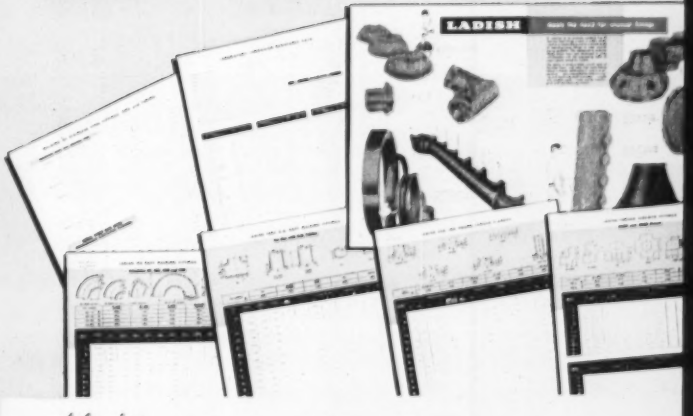

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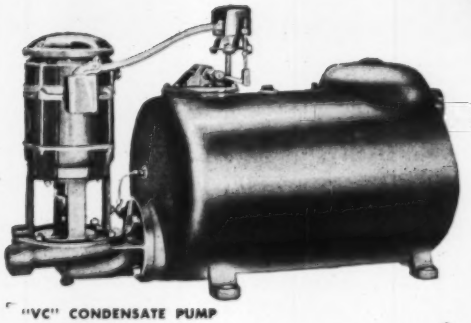

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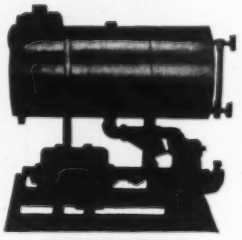

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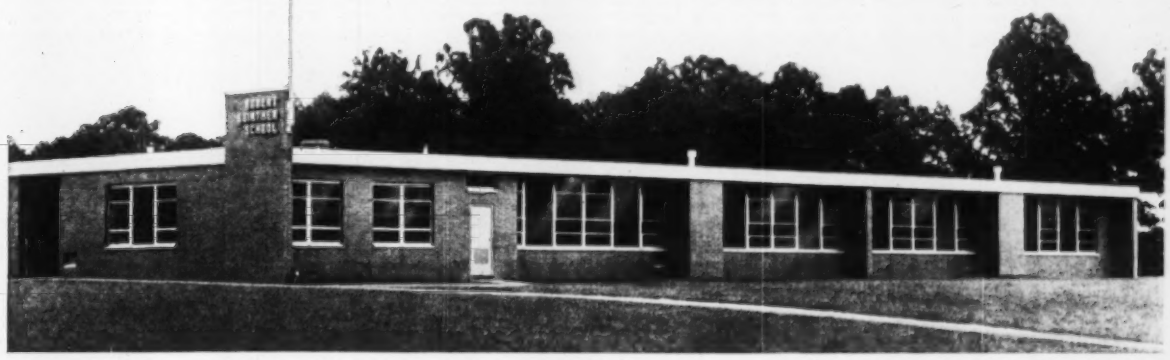

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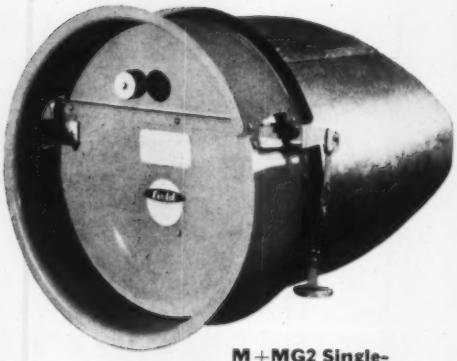

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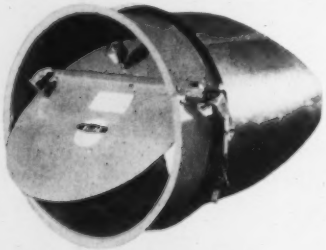

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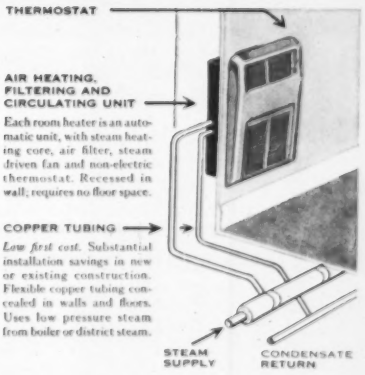
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City _____
Zone _____ State _____

Bethcon coating stays tight in the toughest forming jobs

You can make snap locks, Pittsburgh lock seams or some special seam of your own without damaging the zinc coating on a Bethcon sheet. That's because Bethcon is galvanized by a continuous process which bonds the zinc to the base metal much more tightly than conventional methods.

This same process also distributes the zinc evenly over the sheet, producing a finished sheet of uniform thickness and appearance. It also eliminates the bead usually found on the drip ends of hot-dipped sheets.

Another advantage of the Bethcon continuous galvanizing process is the remarkable combination of strength and ductility in the sheet. That's because the basic steel receives a special annealing in the continuous line. You'll find a Bethcon sheet neither too soft nor too stiff, but just right for easy workability and a sturdy end-product.

You can specify Bethcon in any gage from 13 on up, in plain steel or copper-bearing (Beth-Cu-Loy) for extra corrosion-resistance. If you have not yet worked with Bethcon, you might like to talk with someone who has. Or perhaps you'd prefer to discuss it with one of our own men. Either way, you'll get prompt attention by getting in touch with our nearest district sales office.

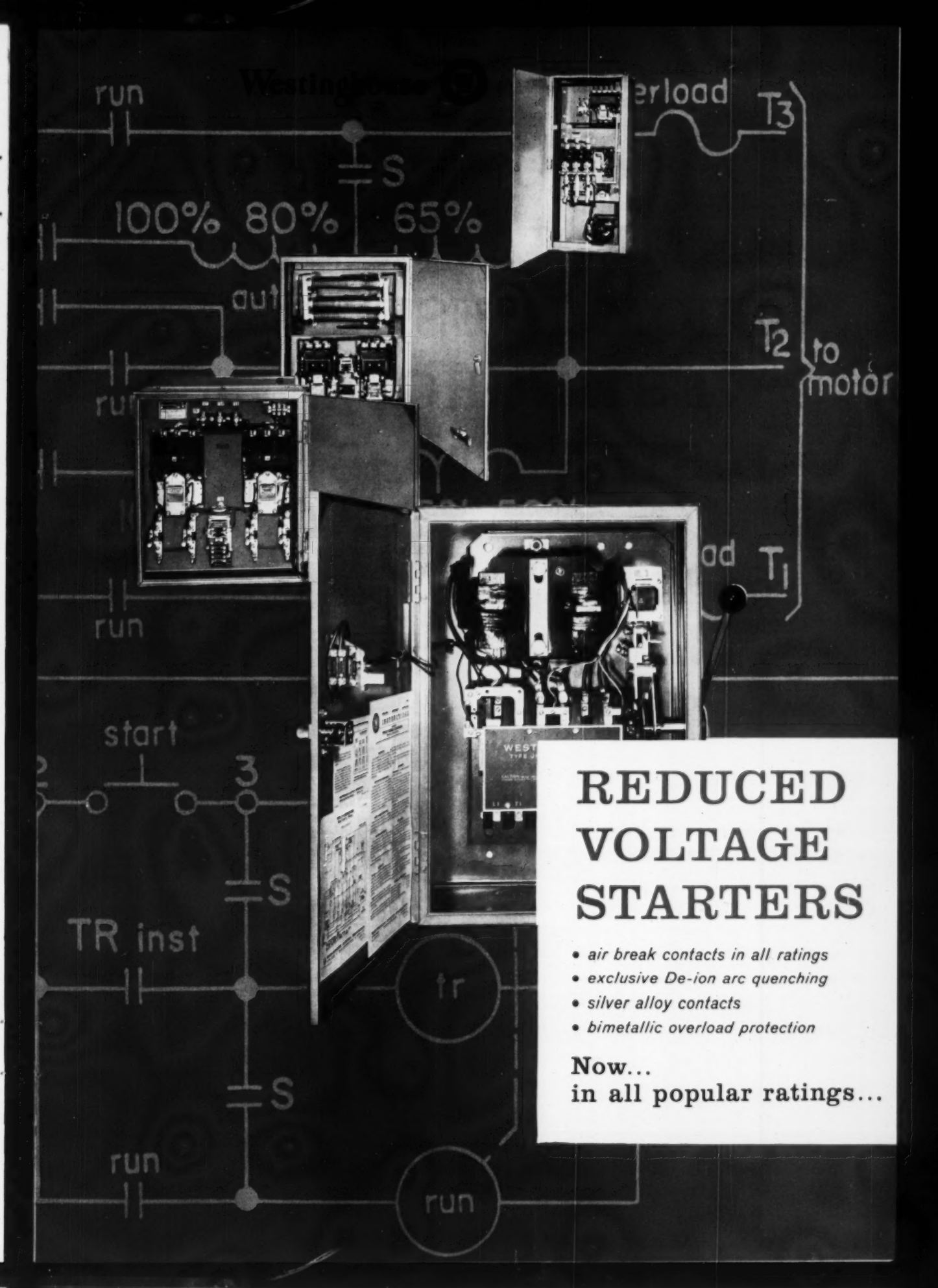
You really ought to try Bethcon. Why not call us now?

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation
Export Distributor: Bethlehem Steel Export Corporation

BETHLEHEM STEEL

BETHLEHEM STEEL



REDUCED VOLTAGE STARTERS

- *air break contacts in all ratings*
- *exclusive De-ion arc quenching*
- *silver alloy contacts*
- *bimetallic overload protection*

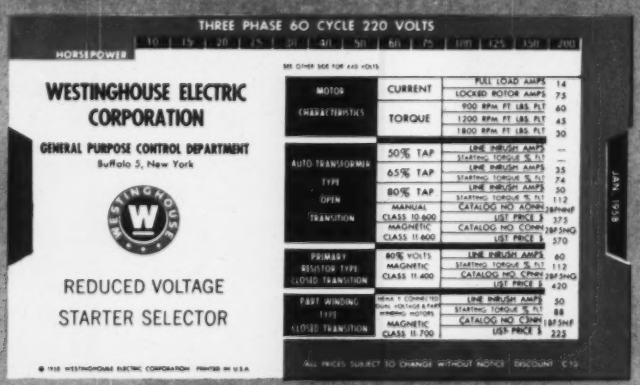
Now...
in all popular ratings...

Westinghouse REDUCED VOLTAGE STARTERS

IMMEDIATE DELIVERY FROM THESE WESTINGHOUSE DISTRIBUTORS

No waiting... no delays. A quick phone call to your nearby Westinghouse distributor gives you prompt delivery and service on the Westinghouse Reduced Voltage Starter you need.

J-22134-2



GET YOUR FREE WESTINGHOUSE STARTER APPLICATION SLIDE RULE

The Westinghouse starter application slide rule is just the "ticket" for easily determining within seconds the exact reduced voltage starter you need for any particular application. Simple to use, with a minimum amount of information required, it will save you considerable time in the accurate selection of all reduced voltage starters.

To obtain your free Westinghouse starter application slide rule, merely phone or write the distributor nearest you whose name and address appear on the following pages. Your free slide rule will be mailed to you immediately.

FROM THESE WESTINGHOUSE DISTRIBUTORS . . . "OFF THE SHELF" SERVICE FOR ALL YOUR REDUCED VOLTAGE STARTER NEEDS

ALABAMA

BIRMINGHAM
Moore-Handley
AL 2-4121

MOBILE
Moore-Handley
HE 3-7411

MONTGOMERY
Moore-Handley
AM 3-5534

ARIZONA

PHOENIX
Westinghouse Electric Supply Co.
1110 North 21st Avenue
AL 8-8211

ARKANSAS

LITTLE ROCK
Westinghouse Electric Supply Co.
119 Sherman Street
FRanklin 2-5154

CALIFORNIA

HAYWARD
Westinghouse Electric Supply Co.
21612 Western Boulevard
EL 1-6442

LOS ANGELES 54
Westinghouse Electric Supply Co.
905 East Second Street
MAdison 9-4161

NORTH HOLLYWOOD
Westinghouse Electric Supply Co.
13213 Sherman Way
POplar 5-8916 STanley 7-2578

OAKLAND
Westinghouse Electric Supply Co.
711 East 8th Street
TE 4-9900

SAN JOSE
Westinghouse Electric Supply Co.
292 Stockton Avenue
CYpress 7-5929

TULARE
Turnupseed Electric Service, Inc.
340 East Inyo MUrdock 6-3401

COLORADO

DENVER
Mine & Smelter Supply Co.
3800 Race Street
KEystone 4-3111

Wazee Electric Co.
2020 West Barberry Place
AComa 2-4533

DISTRICT OF COLUMBIA

WASHINGTON 18
Westinghouse Electric Supply Co.
935 Brentwood Road, N. E.
HUdson 3-8974

FLORIDA

JACKSONVILLE 6
Westinghouse Electric Supply Co.
545 East Fourth Street
ELgin 3-7431

GEORGIA

ALBANY
Westinghouse Electric Supply Co.
610 North Washington Street
HE 2-1285

SAVANNAH
Westinghouse Electric Supply Co.
580 Indian Street ADams 3-9682

IDAHO

BOISE
Westinghouse Electric Supply Co.
318 South Capitol Boulevard
P. O. Box 1518 2-3531

ILLINOIS

CHICAGO 7
Westinghouse Electric Supply Co.
113 North May Street
TAylor 9-5000

DANVILLE
Westinghouse Electric Supply Co.
603 North Gilbert Street 1901

ROCKFORD
Westinghouse Electric Supply Co.
2121-15th Street 8-2471

INDIANA

EVANSVILLE
Westinghouse Electric Supply Co.
1251 Diamond Avenue HA 3-1152

INDIANAPOLIS 7
Westinghouse Electric Supply Co.
1560 Stadium Drive ME 2-3301

TERRE HAUTE
Walker Electric Supply Co., Inc.
124-130 South Third Street
C-1385

IOWA

DAVENPORT
Westinghouse Electric Supply Co.
402 East Fourth Street 3-9966

DES MOINES
Westinghouse Electric Supply Co.
2515 Dean Avenue AM 2-3181

FORT DODGE
Iowa Electric Supply Co.
1012 First Avenue, North 7-2311

WATERLOO
Westinghouse Electric Supply Co.
300 West Third Street
ADams 4-4679

KANSAS

WICHITA
Westinghouse Electric Supply Co.
2940 South Minneapolis HO 4-5394

KENTUCKY

LOUISVILLE
Tafel Electric and Supply Co.
333 East Brandeis Street
MElrose 6-1381

LOUISIANA

BATON ROUGE
Westinghouse Electric Supply Co.
2511 Michelli Drive
EL 7-0603-4-5

MARYLAND

BALTIMORE
Tristate Electrical Supply Co., Inc.
HOpkins 7-5600

CUMBERLAND
Tristate Electrical Supply Co., Inc.
PArkview 2-0060

FREDERICK
Tristate Electrical Supply Co., Inc.
MOnument 2-2136

HAGERSTOWN
Tristate Electrical Supply Co., Inc.
REgent 3-1212

MASSACHUSETTS

PITTSFIELD
Electric Supply and Repair Co., Inc.
48 Pearl Street 2-1539

MINNESOTA

DULUTH
Westinghouse Electric Supply Co., Inc.
230 Lake Ave. S. RA 7-7423

MINNEAPOLIS 15
Westinghouse Electric Supply Co.
515 South Seventh Street
FEderal 8-7001

ST. PAUL 1
Westinghouse Electric Supply Co.
253 East Fourth Street CA 7-6581

MISSOURI

JOPLIN
Continental Electric Co.
415 Junge Boulevard MA 4-2417

KANSAS CITY
Continental Electric Co.
1321 West 13th Street CR 1-1180

MONTANA

BUTTE
Westinghouse Electric Supply Co.
949 South Montana Street 2-2374

KALISPELL
Industrial Supply Co.
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SK 6-5900

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OMAHA
Westinghouse Electric Supply Co.
117 North 13th Street HA 8700

NEVADA

LAS VEGAS
Osborne Electric Supply Co., Inc.
835 West Bonanza Road
DUdley 2-7393

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NEWARK 5
Westinghouse Electric Supply Co.
528 Ferry Street MI 2-3450

TRENTON 9
Westinghouse Electric Supply Co.
745 East State Street OWen 5-5421

NEW MEXICO

ALBUQUERQUE
Westinghouse Electric Supply Co.
816 First Street, N.W. CH 3-3708

NEW YORK

BUFFALO 2
Buffalo Electric Co., Inc.
75 West Mohawk Street WA 4420

JOHNSON CITY
Westinghouse Electric Supply Co.
419 Grand Avenue 9-1561

POTSDAM
Van Ness Co., Inc
29 Depot Street 9328

SYRACUSE
Westinghouse Electric Supply Co.
961 West Genesee Street 74-3331

NORTH CAROLINA

RALEIGH
Electric Motor & Repair Co.
P. O. Box 1950 TEmple 3-2781

NORTH DAKOTA

FARGO
Westinghouse Electric Supply Co.
405-14th Street, North 2-4446

OHIO

CLEVELAND 14
H. Leff Electric Co.
2341 Payne Avenue TOwer 1-7400

Westinghouse Electric Supply Co.
1809 East 22nd Street TOwer 1-5660

Westinghouse Electric Supply Co
700 East 165th Street IVanhoe 1-7840

COLUMBUS 15
Westinghouse Electric Supply Co.
266 North Fourth Street
CApital 1-5571

YOUNGSTOWN 1
The Phoenix Electric Co.
533 Lincoln Avenue RIverside 4-4519

OKLAHOMA

OKLAHOMA CITY
Westinghouse Electric Supply Co.
850 N.W. Second CEntral 2-7101

TULSA
Westinghouse Electric Supply Co.
307 East Brady DI 3-7155

OREGON

EUGENE
Tillman & Booth, Inc.
215 West Fifth DI 5-3301

KLAMATH FALLS
Tillman & Booth, Inc.
Sixth & Broad TU 4-4171

East Side Electric Co.
P. O. Box 190
TUxedo 4-3184

MEDFORD
Westinghouse Electric Supply Co.
P. O. Box 1152 SP 3-4556

PORTLAND 9
Westinghouse Electric Supply Co.
815 N. W. 12th Avenue CA 2-9851

PENNSYLVANIA

CHAMBERSBURG
Tristate Electrical Supply Co., Inc.
CO 4-4631

PHILADELPHIA
Westinghouse Electric Supply Co.
141 North 11th Street WA 2-8950

PITTSBURGH 12
Westinghouse Electric Supply Co.
209 West General Robinson Street
FA 2-5500

SOUTH CAROLINA

COLUMBIA
Electric Motor and Repair Co.
P. O. Box 806 ALpine 2-2181

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CHATTANOOGA
Mills & Lupton Supply Co.
749 East 12th Street AM 6-6171

KNOXVILLE
Westinghouse Electric Supply Co.
403 East Fifth Avenue 4-8644

MEMPHIS
Shelby Electric Co., Inc.
112 East E. H. Crump Boulevard
Whitehall 8-1546

Westinghouse Electric Supply Co.
845 North Main Street JA 7-9431

NASHVILLE
Tafel Electric & Supply Co.
401 Sixth Avenue, South CH 2-7305

TEXAS

BEAUMONT
Westinghouse Electric Supply Co.
1655 Louisiana Street
TErminal 3-6333

CORPUS CHRISTI
Westinghouse Electric Supply Co.
110 North Staples Street
TU 2-3351

EL PASO
Triangle Electric Supply Co.
333 West San Antonio Street
KEystone 3-1611

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Westinghouse Electric Supply Co.
1903 Ruiz CA 5-1341

LUBBOCK
Westinghouse Electric Supply Co.
605 Main Street POrter 5-6396

SAN ANTONIO 6
The Perry Shankle Co.
1801 South Flores Street
CA 6-5191

Westinghouse Electric Supply Co.
1211 East Houston Street
CA 7-9271

UTAH

OGDEN
Westinghouse Electric Supply Co.
2660 Lincoln Street
EXport 4-2691

SALT LAKE CITY
Westinghouse Electric Supply Co.
210 Rio Grande Street
DAvis 2-2441

VIRGINIA

HARRISONBURG
Tristate Electrical Supply Co., Inc.
4-7514

RICHMOND
Westinghouse Electric Supply Co.
511 East Byrd Street MI 3-0111

ROANOKE
Westinghouse Electric Supply Co.
19th Street & Salem Avenue, S. W.
DIamond 4-3271

WASHINGTON

SEATTLE 4
Westinghouse Electric Supply Co.
1051 First Avenue, South MAin 3-7001

SPOKANE
Westinghouse Electric Supply Co.
N. 1023 Monroe Street FA 8-3371

TACOMA 2
Westinghouse Electric Supply Co.
1325 South Tacoma Way GR 4-9476

WISCONSIN

GREEN BAY
Westinghouse Electric Supply Co.
619 Main Street HEmlock 5-3751

MADISON
Westinghouse Electric Supply Co.
110 North Thornton Avenue
AL 5-4867

MILWAUKEE
Westinghouse Electric Supply Co.
546 North Broadway BR 6-1800

J-22134-1-2-3

ARE YOU PAYING HIGHER

Check these HIDDEN COSTS in

In figuring the cost of air conditioning and heating equipment, there's only one cost that counts—*installed cost.* Installed cost includes all the *hidden, extra costs of completing the job.*

Equipment bought on low delivered price often costs more *installed* than quality Kennard equipment. Why? Because Kennard equipment is engineered to eliminate the hidden costs . . . the extra labor and materials needed to complete the job. Kennard design and construction features make the difference. Many of these quality features that help cut hidden costs and give more satisfactory service are *exclusive* with Kennard, and they're standard, at no extra cost.

An ever-growing number of contractors have learned, from actual experience, how Kennard equipment can eliminate or reduce many hidden installation costs. Job after job has proved it to them. Their sub-contractors and their own craftsmen—familiar with all brands of equipment—have helped show them the installed cost savings that Kennard equipment makes possible.

Let your own experience prove that Kennard quality can actually cost less. Just check the list of common hidden costs against your own recent jobs using equipment bought on *low price.* Then, check the Kennard quality features that can cut those hidden costs to give lower *installed cost.*

On your next job, figure the cost of equipment in installed cost, *the only cost that counts,* rather than on delivered price. Your local Kennard Representative will help show you how to profit from quality. He'll give you information, too, on new units that make the Kennard line of air conditioning and heating equipment even more complete.

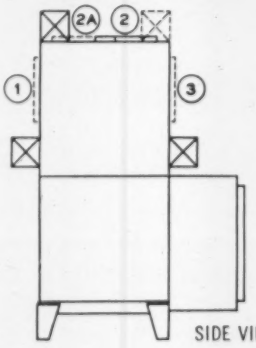
Representatives In All Principal Cities

☐ **DUCTWORK**
Extra ductwork, elbows and turns required by limited choice, or no choice, of blower air discharge positions and unit arrangements.

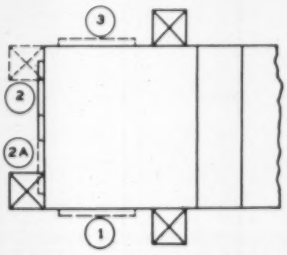
☐ **DAMAGE**
Extra cost of repairing handling damage—ruined insulation, air leaks, dents—when panels are large and flimsy.

Here's why KENNARD

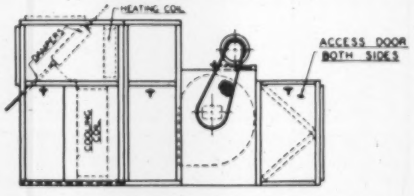
CHOICE OF DISCHARGE AND MOTOR POSITIONS



SIDE VIEW—VERTICAL UNIT



SIDE VIEW—HORIZONTAL UNIT



SIDE VIEW—HORIZONTAL MULTI-ZONE UNIT

Kennard units offer a cost-saving choice of blower discharge and air intake positions, and unit arrangements. These choices of vertical or horizontal positions, to match risers and laterals, eliminate elbows, shorten ducts, reduce duct resistance, solve space problems. Choice of motor positions, too, helps cut installation costs, particularly in crowded equipment rooms.

KENNARD
ST. LOUIS 14,

PRICES FOR LOWER QUALITY

YOUR Air Conditioning and Heating Jobs...

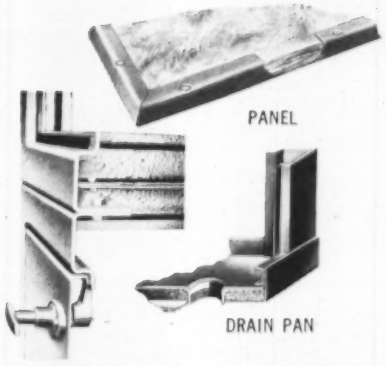
☐ **HOISTING-RIGGING**
Extra cost of handling units not rigidly framed and not having separate, self-supporting sections.

☐ **ASSEMBLY**
Extra labor to complete the factory's assembly; re-working to get proper fit-up of mating surfaces; extra piping.

☐ **DELIVERY**
Extra cost of delivery delays—stand-by and overtime pay; cost of holding up other work.

☐ **CALLBACKS**
Extra cost of correcting troubles where quality was ignored to "get under the wire" on price.

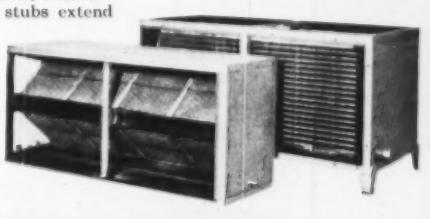
QUALITY Costs Less Installed!

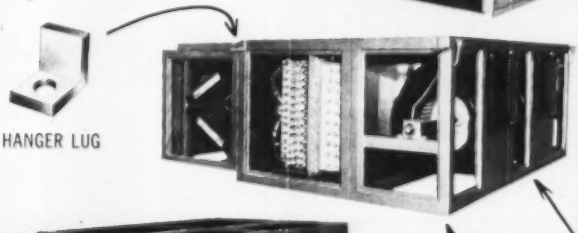


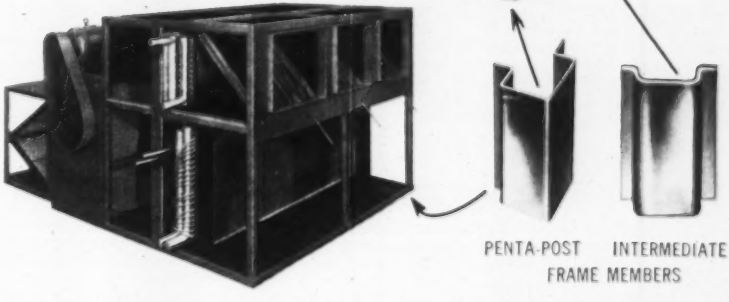
The edges of all Kennard panels are double flanged to provide rigidity and a protective covering over the edge of the insulation. Drain pan insulation is protected by *double pan* construction, with the insulation sealed *between* the inner and outer pans.

Kennard's strong, rigid, welded frames, featuring PENTA-POST construction, give maximum strength with minimum weight. Hanger lugs on suspended units, and lifting eyes on vertical units, simplify hoisting. Self-supporting sections handle easily, move through small openings, won't buckle out of alignment during hoisting and rigging. For every type of installation —suspended, floor mounted, equipment room, roof—Kennard equipment is designed for easier, lower-cost installation.

Kennard units are sectionalized for easier handling, more flexible arrangement, but each section assembly is complete—not knocked down. Mating faces are precision manufactured, bolt together quickly and easily, require no re-working. Thermal expansion valves are factory installed inside the unit, with the liquid line piped to the outside. Coil stubs extend outside the cabinet for easy piping connection, and are grommeted to prevent air leakage. Panels and doors are easily removable to give workmen full access to all parts of the units, regardless of installed position and crowded conditions.



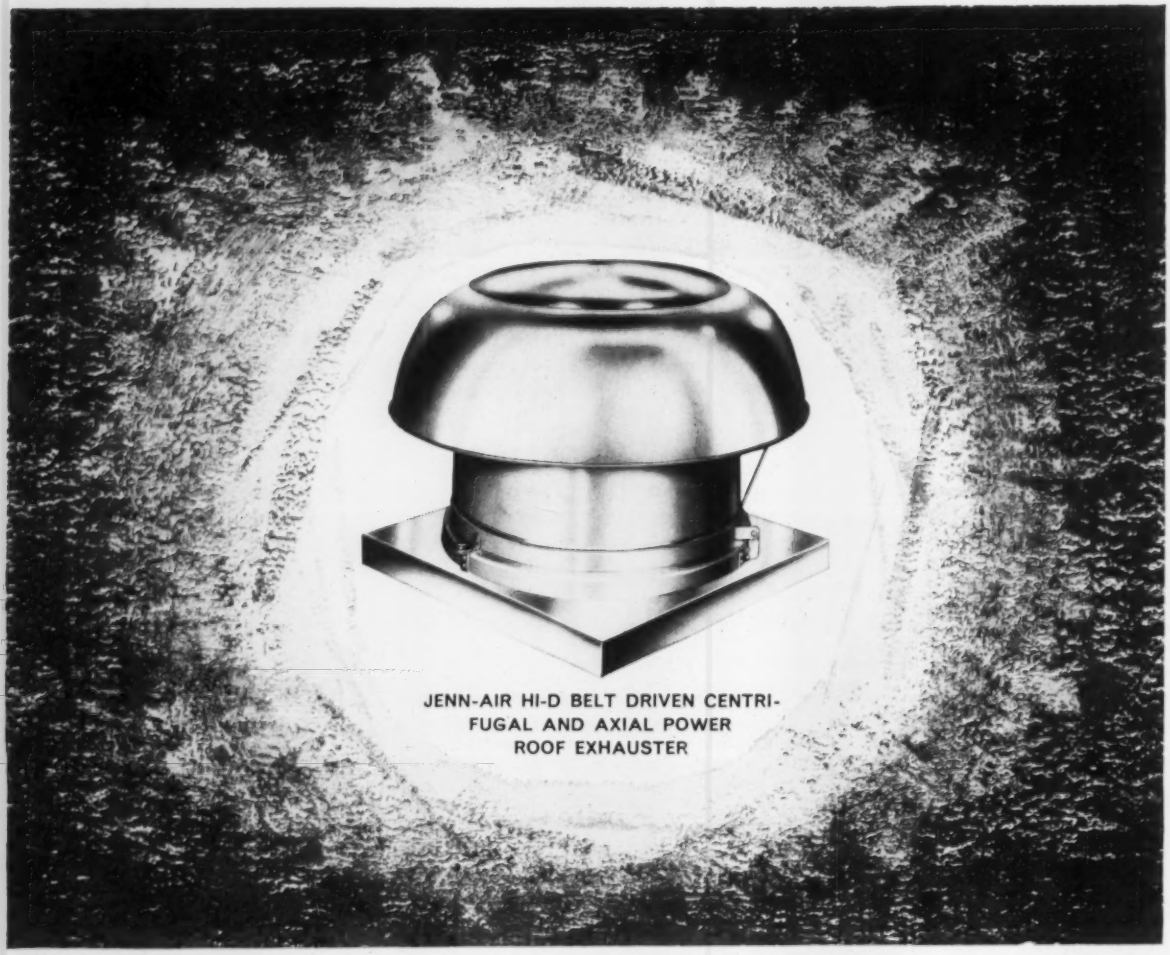




DELIVERY: Kennard's reputation for on-time delivery is carefully guarded and backed up with reliable production schedules. In Kennard's larger, all-new factory, with doubled production capacity, your orders will be manufactured in the shortest possible time, under rigid quality control. Kennard can, and does, give special attention and faster shipping schedules whenever a job is progressing more rapidly than anticipated and the contractor needs the equipment earlier.

CORPORATION

MISSOURI



JENN-AIR HI-D BELT DRIVEN CENTRIFUGAL AND AXIAL POWER ROOF EXHAUSTER

Hi-D MEANS HIGH DISCHARGE and LOWER ROOF MAINTENANCE

HI-D CENTRIFUGAL POWER ROOF EXHAUSTER
Unit in open position, showing ready access to drive assembly.

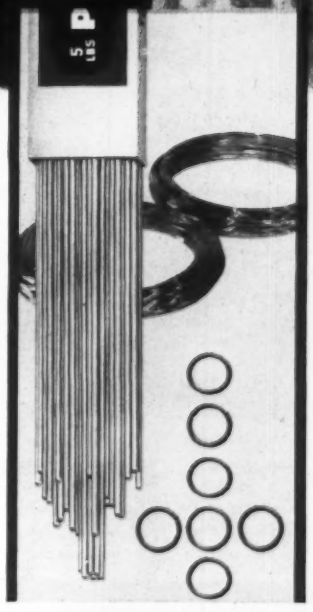
HI-D AXIAL POWER ROOF EXHAUSTER
Unit in open position, showing ready access to drive assembly.

New JENN-AIR aluminum belt-driven units meet industry's need for exhausters that combine high discharge with low contour appearance.

Often times it is advantageous to avoid direct discharge of air onto a built-up roof. Hi-D with no increase in curb height averages double the discharge height of ordinary fans. It likewise offers advantages in areas where drifted snows require higher discharge height. Ordinarily this would mean the use of higher curbs and unsightly projection above the roof line. Once you compare, you will decide on Jenn-Air.

JENN-AIR PRODUCTS COMPANY, INC.
1102 Stadium Drive, Indianapolis 7, Indiana

the meaning of custom-made quality brazing alloys



In coils, straight lengths, or preformed rings, Phoson and Sil-Bond brazing alloys are available through welding supply dealers everywhere in the United States.

Scientific COLOR analysis keys quality control of United Phoson and Sil-bond brazing alloys

Brazing results depend upon alloy uniformity . . . that's why United scientifically controls this vital factor through the modern miracle of *spectrographic analysis.* Skilled technicians *arc test* United Phoson and Sil-Bond alloys. This sets up a color spectrum which is analyzed by ultramodern, spectrographic equipment . . . and results in the most positive alloy check ever developed!

Spectrographic control coupled with United's continuous casting production processes are the reasons why Phoson and Sil-Bond alloys assure uniform results, speed up production and reduce finishing requirements.

A colorful new 8-page booklet, "Low Temperature Brazing Engineering Facts and Data" is packed with valuable information which you need for more profitable brazing. A copy is yours free. Write, wire or phone, today.

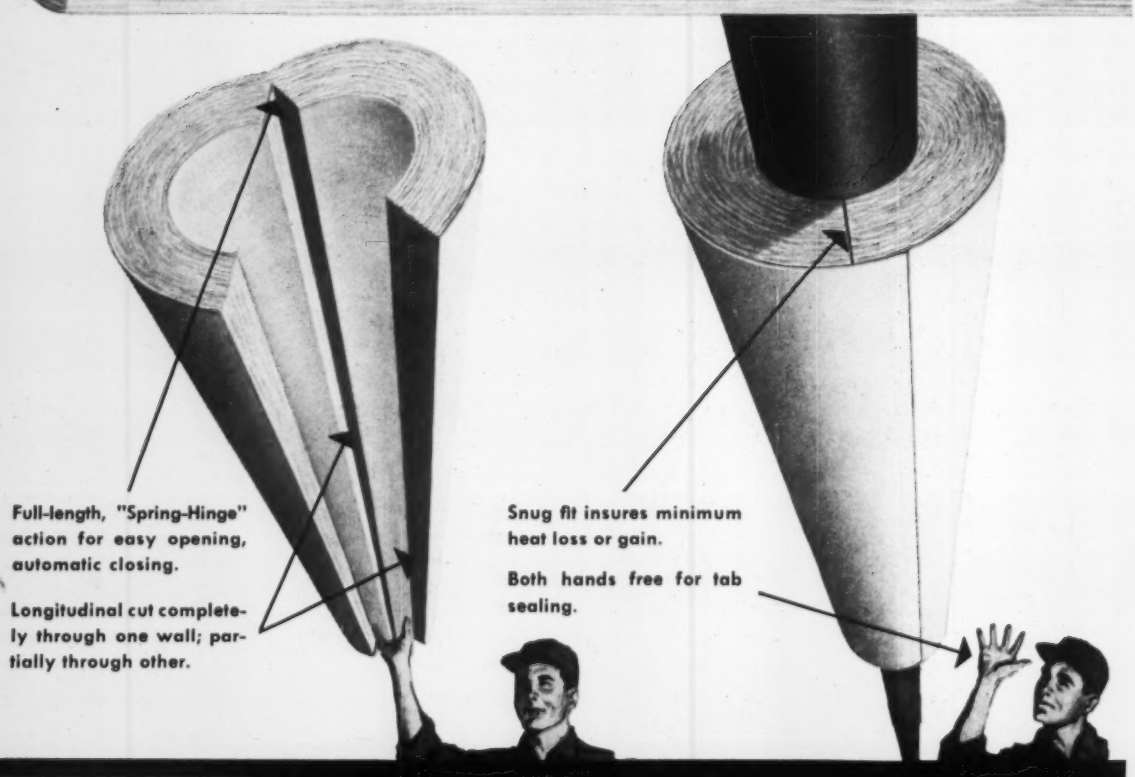
UNITED WIRE AND SUPPLY CORPORATION
1497 Elmwood Avenue, Providence, Rhode Island

Plan to visit Booth 1142 at the Cleveland Metal Show, October 27-31.

Precision United *Specify* **UNITED** *for brazing alloys ... aluminum, brass, copper tube and wire*

MICRO·LoK

PIPE INSULATION*


Full-length, "Spring-Hinge" action for easy opening, automatic closing.
Longitudinal cut completely through one wall; partially through other.
Snug fit insures minimum heat loss or gain.
Both hands free for tab sealing.

HERE'S A "BIRD'S-EYE" VIEW OF MICRO·LoK:

"Spring-Hinge" Action

One-piece construction and automatic closing feature introduces new savings in application costs; increases efficiency of workers by quickly freeing hands for sealing tabs and other operations.

Light in Weight

Three foot section of 1" thick MICRO•LoK for fitting 2" pipe weighs ¼ lb. L.F.—only ⅛th the weight of insulations which require more thickness to do the same job.

Excellent Thermal Performance

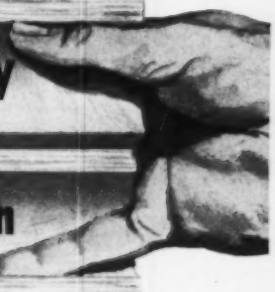
Made of finer, longer fibers, it has efficiency equal to or better than commonly used insulations. Temperature limit is 350° F.—unaffected by sub-freezing temperatures.

*PATENTS APPLIED FOR

©1958 L·O·F Glass Fibers Company

Look to L·O·F Glass Fibers for the NEW things in fiber glass

Another first from L·O·F Glass Fibers Company



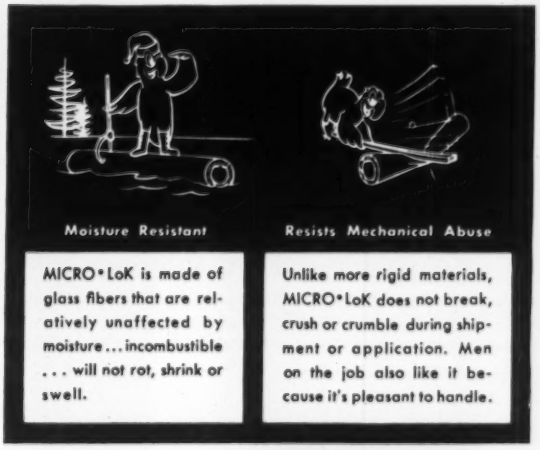
for better performance and faster application

featuring full-length, "Spring-Hinge" action

1. The *first* one-piece, full-length "Spring-Hinge" action for easy opening and automatic closing.

2. The *first* fiber glass pipe insulation that permits easy cutting and fitting of the inside diameter around couplings, unions, pipe hangers and other irregularities.

The L·O·F Glass Fibers' process permits production of all standard wall thicknesses —especially ½" and ¾" walls—for all pipe and copper tubing sizes.


Moisture Resistant
MICRO•LoK is made of glass fibers that are relatively unaffected by moisture... incombustible ... will not rot, shrink or swell.
Resists Mechanical Abuse
Unlike more rigid materials, MICRO•LoK does not break, crush or crumble during shipment or application. Men on the job also like it because it's pleasant to handle.

SUPERIOR THERMAL EFFICIENCY

LESS WALL THICKNESS REQUIRED

TEMPERATURE LIMIT OF 350° F.

UNAFFECTED BY SUB-FREEZING TEMP.

FASTER APPLICATION AT LOWER COST

MICRO·LoK Pipe Insulation is available in factory applied jackets—including canvas, vapor barriers, flame resistant—for all operating conditions, whether hot or cold, concealed or exposed, indoor or outdoor.

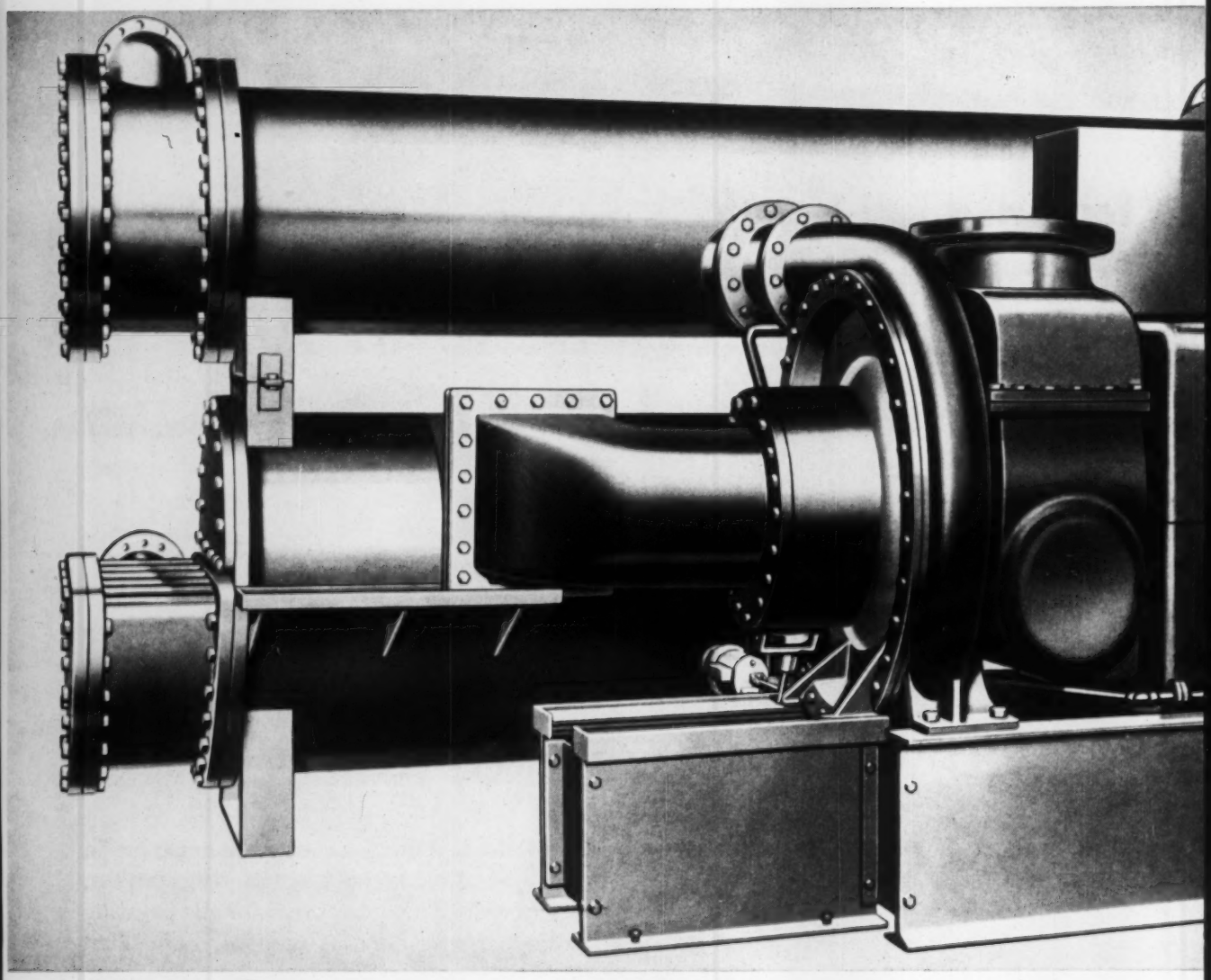
For more information on sizes, recommended thicknesses and application, call or write the nearest L·O·F Glass Fibers Company sales Office.

L·O·F GLASS FIBERS

L·O·F GLASS FIBERS COMPANY

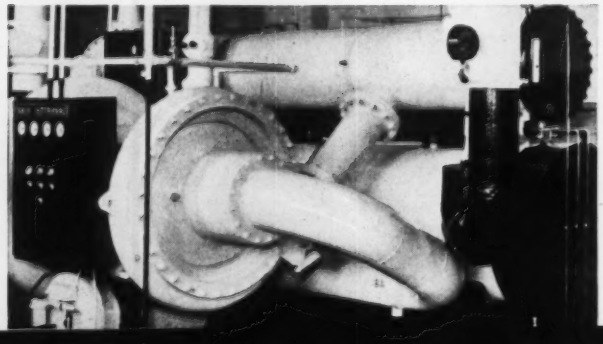
TOLEDO 1, OHIO

TRANE ANNOUNCES with

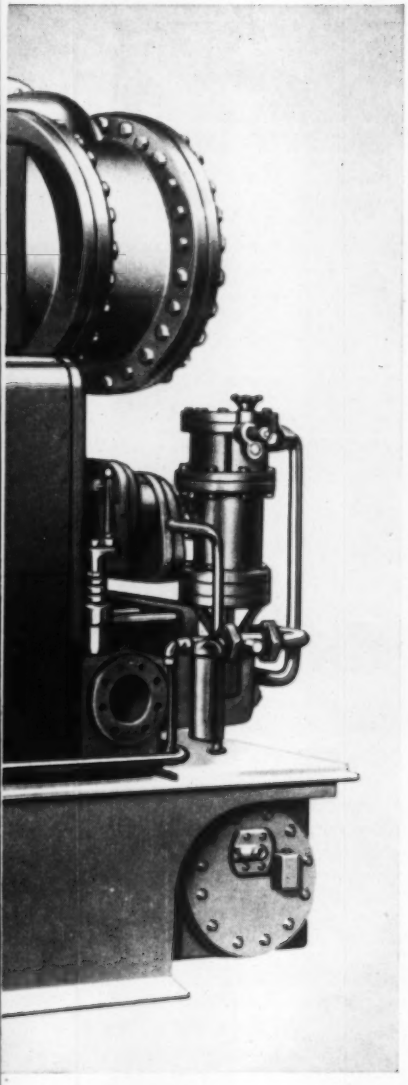


The Turbine CenTraVac reduces refrigeration costs to a minimum . . . brings new savings to plants and buildings where steam is available. Constant speed operation with prerotation vane capacity control improves performance at all part-load conditions. Compressor and turbine factory-assembled on a common base to eliminate field alignment problems. 300 to 1600 tons.

Hermetic CenTraVac water chiller with electric drive has been specified for more installations than all other makes combined! Modulates to 10% of capacity or lower, with power savings in almost direct proportion to load.



A CenTraVac® steam turbine drive



Now! Lower steam refrigeration costs, simplified installation with the Turbine CenTraVac—300 to 1600-ton water chillers.

Here's the first major advance in twenty years in the field of turbine refrigeration equipment! It's the TRANE Turbine CenTraVac, a centrifugal water chiller that combines the efficient CenTraVac compressor design with steam turbine drive—plus advantages not found in other turbine refrigeration units.

- **More efficient design.** Fewer moving parts. Impeller mounted on extended turbine shaft eliminates thrust and journal bearings.
- **Simplified installation.** Integral assembly of compressor and turbine eliminates critical field alignment problems.
- **Superior seal design.** Only ring collar of shaft seal rotates. Positive separation of oil and refrigerant.

Next time you plan an air conditioning system, consider the dependable TRANE Turbine CenTraVac. It's a complete water chilling system, simple in design, simple to install, quiet and vibration-free. It may be installed on any level surface, with no special bases. Wherever there is a supply of steam, it will provide new economy—with all the traditional quality and dependability of the hermetic CenTraVac.

Want more facts? Call your nearby TRANE Sales Office, or write TRANE, La Crosse, Wisconsin.

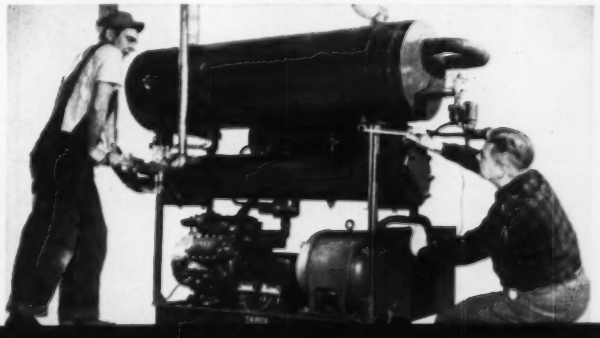
For any air condition, turn to

TRANE

MANUFACTURING ENGINEERS OF AIR CONDITIONING, HEATING, VENTILATING AND HEAT TRANSFER EQUIPMENT

THE TRANE COMPANY, LA CROSSE, WIS. • SCRANTON MFG. DIV., SCRANTON, PA. • CLARKSVILLE MFG. DIV., CLARKSVILLE, TENN. • TRANE COMPANY OF CANADA, LIMITED, TORONTO • 97 U.S. AND 19 CANADIAN OFFICES

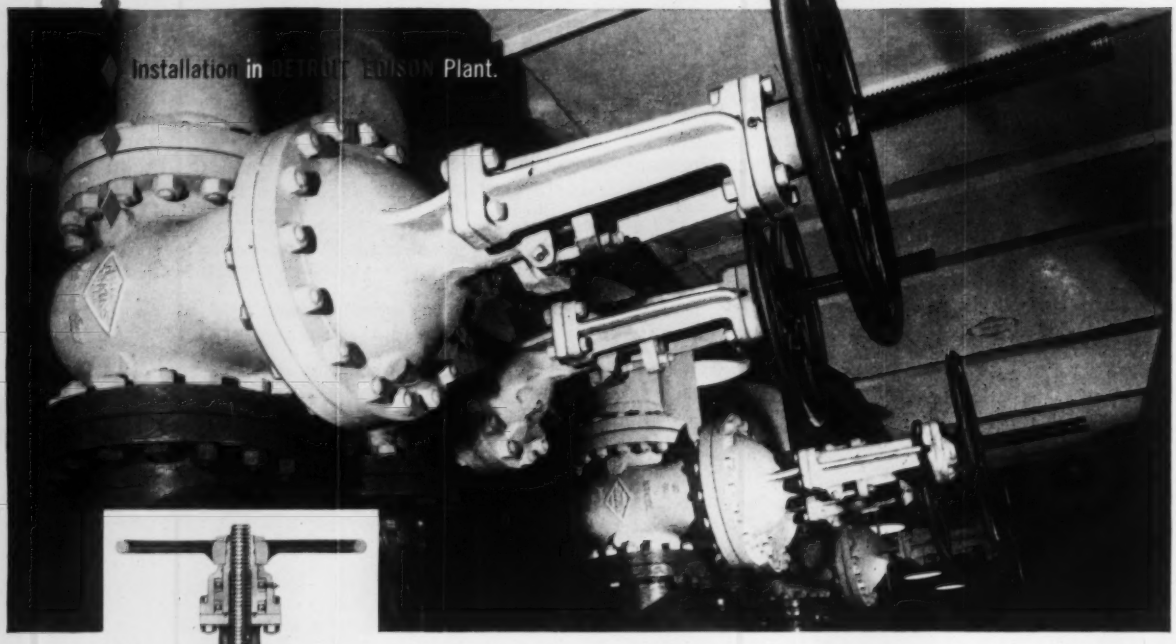
For smaller jobs, the TRANE Cold Generator gives you a packaged water chiller in sizes from 10 to 150 tons. 4-step compressor modulation cuts power consumption. Factory pre-assembly includes automatic control panel.



Individually controlled UniTrane units filter all the air. Fan-coil and induction units available for floor, ceiling and concealed installation. New low-silhouette induction unit (illustrated) fits under low windows.

where they really know Costs

—you'll likely see the famous Jenkins mark on CAST STEEL Valves



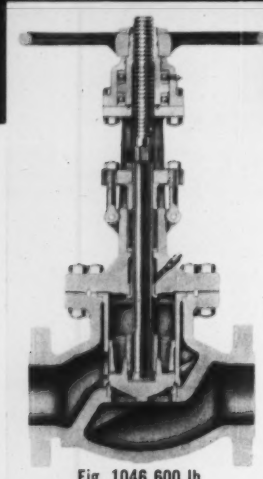


Fig. 1046 600 lb.
O.S. & Y. Globe

In the power generation and industrial processing plants where Cast Steel valves are numbered by the score . . . where replacement and maintenance costs are recorded to the last penny . . . the true economy of Jenkins Valves is clearly seen.

Records will always show the extra value which Jenkins builds into Cast Steel valves, not only with design features you can see but also with unbending quality standards for alloys, castings, machining. Plus the toughest known testing and inspection system to assure perfection in every detail, and safety factors far beyond ratings.

Select from the Big Line in this Catalog. It includes pressure castings of Carbon, Carbon-Moly, 1¼% Chromium-Moly, 4% — 6% Chromium-Moly, 3½% Nickel . . . alloys that meet a wide variety of specifications. Also, a wide choice of patterns, sizes and seating material combinations to satisfy your different service conditions.

CALL YOUR JENKINS DISTRIBUTOR for a copy of Jenkins Cast Steel Valve Catalog and prices. Or write to Jenkins Bros., 100 Park Ave., New York 17.

Typical Jenkins features deliver lasting economy

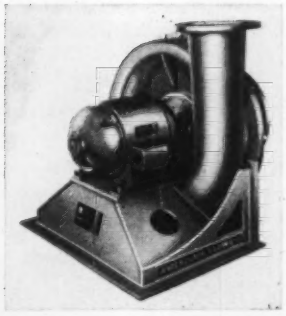
A ball bearing yoke sleeve is standard on larger sizes • Cooling chamber and plugged connection for test purposes is regularly provided below packing box, but a lantern gland stuffing box is optional • Rustproof, lubricated and graphited, wire reinforced packing is standard • Soft steel ring joint body-bonnet gasket, fitted into accurately matched grooves to assure a vapor-tight joint • Seating is regrind-renew type.

JENKINS
LOOK FOR THE JENKINS DIAMOND
VALVES
JENKINS SINCE 1864 Jenkins Bros.

Sold Through Leading Distributors Everywhere

EQUIPMENT DEVELOPMENTS . . .

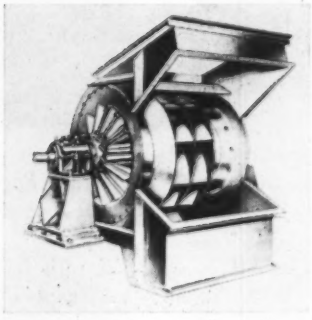
For reviews of Recent Trade Literature see Page 222



Centrifugal Compressor . .

. . .in expanded line—*American-Standard, American Blower Div., Dept. HPAC, Detroit* 32.

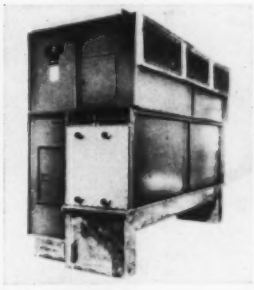
New single-stage sizes in centrifugal compressor line range from 25 to 2500 hp, with pressures from 1 to 7½ psig and intake volumes from 2000 to 3600 cfm and discharge pressures from 1¾ to 6 psig with speeds to 3600 rpm. Impellers are of shrouded type with either radial or backwardly curved blades.



Heavy-Duty Fans . . .

. . .designed specifically for mechanical draft, other heavy-duty applications—*Westinghouse Sturtevant Div., Dept. HPAC,* 200 *Readville St., Hyde Park, Boston* 36.

"Series 4000" airfoil fans may be used as forced-draft fans for combustion air supply with open inlets; with inlet boxes to handle preheated air, industrial process supply, exhaust applications, induced draft fans for oil or gas firing applications. Available in 15 sizes with capacities 10,000 to 700,000 cfm and with static pressures at fan outlet to 45 in. water gage. For operating temperature range from −20 to 850 F.



Heat Exchanger . . .

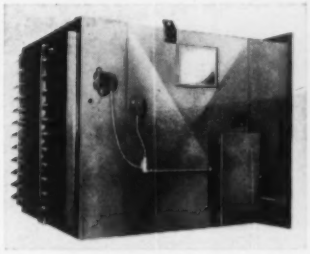
. . .in line developed for liquid and gas cooling in industrial processing applications—*Niagara Blower Co., Dept. HPAC,* 405 *Lexington Ave., New York* 17.

Evaporation of water spray over cooling coils of heat exchanger provides cooling effect at rate of about 1000 Btu per lb of water evaporated. Special features cited include cleanable coils, "winter-summer" dampers for outdoor installation in severe climates. Unit is constructed in removable panel sections Range of sizes available providing capacities to 18 million Btu per hr under standard conditions.

Hot Water Boilers . . .

. . .designed to modulate gas input automatically with changing load conditions without impairing overall boiler efficiency—*Hydrotherm, Inc., Dept. HPAC, Clinton Ave., Northvale, N. J.*

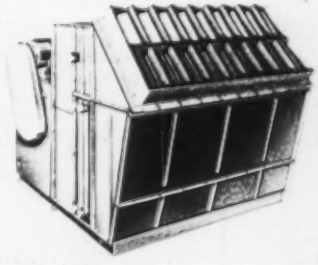
Full input on "Multi-Temp" boilers used only for peak loads and when warming up from cold start; at other times input is kept to fraction of full capacity in accordance with actual heating demand. Unit is composed of individual cast iron heat exchangers with patented horizontal sections which are manifolded into common supply, return header. Each exchanger has its own combustion chamber and set of gas controls, will fire in response to modulating aquastats in return header. Boilers have input ratings to 3,600,000 Btu for use on manufactured, natural, propane gas.



Make-Up Air Unit . . .

. . .designed to temper, filter outside air entering ventilated areas—*Aerovent Fan Co., Inc., Dept. HPAC,* 740 *E. Ash St. Piqua* 29, *Ohio.*

Gas fired, industrial air makeup units engineered to operate with natural, mixed, manufactured and propane gases. Available in four unit arrangements in four sizes 36 to 54 in. for various capacities, Btu ratings, pressure conditions. Only fuel and electrical connections needed for installation, says manufacturer.



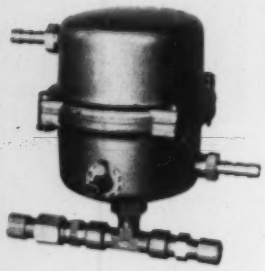
Multi-Zone Units . . .

. . .designed for commercial buildings in multiple-zone applications—*Westinghouse Sturtevant Div., Dept. HPAC,* 200 *Readville St., Hyde Park, Boston* 36.

"Series 1600" is available in seven basic sizes in capacities 4000 to 34,-

EQUIPMENT DEVELOPMENTS
Continued

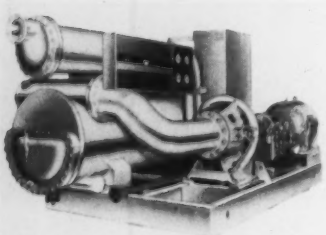
000 cfm to handle up to 16 different zones. Units are of blow-through type with outlets divided for either cooled or heated air or controlled mixtures of the two to each zone. Fan wheels designed with 60 deep, closely spaced, forward curved fan blades of corrosion resistant alloy steel. Number of zones possible with single unit varies with unit size. All sets of dampers interconnected with single connecting rod cut in field to suit required number of zones. Individual zone control obtained by use of separate modulating damper motors.



Static Pressure Regulator

. . . designed for individual room control of air—*Powers Regulator Co., Dept. HPAC, 3434 Oakton St., Skokie, Ill.*

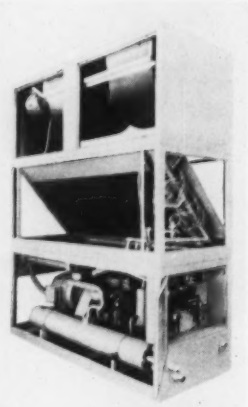
"Constant Air Volume" regulator operates on 15 psi air supply, will respond to 0.005 in. WG. Maximum ambient temperature is 140 F. Regulator linked to pneumatic motors which open or close damper valves admitting hot, cold air to mixing box. Hot air damper also actuated by room thermostat.



Compressor-Chiller . . .

. . . designed for water cooling applications up to 350 tons—*York Corp., Subsidiary of Borg-Warner Corp., Dept. HPAC, Roosevelt Ave., York, Pa.*

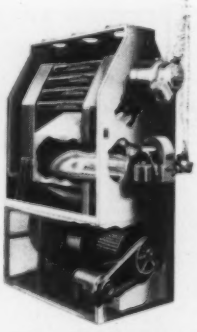
"Turbopak" is packaged, one-piece system said to be fully factory-assembled including controls, motor starter, control piping, wiring. Unit is built on one-piece rigid base in 150, 200, 275, 350 bhp models.



Packaged Air Conditioner

. . . for winter-summer, commercial and industrial use—*Dialatemp Corp., Dept. HPAC, St. Louis* 1.

"Dialaire" available in three models, nine sizes 15 to 100 tons. Unit is self-contained package type with necessary piping, wiring, controls. Available models are: "WCD" with water cooled condenser; "WSD" with built-in water saver requiring small amount of makeup water; "ACD" with matched air cooled condenser. Two types of heating coils are offered: conventional hot water coil; non-stratifying steam coil.



Direct Fired Heaters . . .

. . . designed for installation in institutions, industrial and commercial buildings—*Arkos Mfg. Co., Dept. HPAC, 7310 Woodward Ave., Detroit.*

Heaters have stainless steel combustion chambers with four point floating suspension designed for free movement during heating, cooling cycles. Standard capacities range 400,000 to 3,500,000 Btu per hr with light oil burners, heavy oil burners, gas burners or combination oil-gas burners. Five models available for floor, horizontal or vertical mounting, with separate blower compartments or in portable style. Optionally equipped with duct inlet, outlet connections, separate blower compartments for bypass systems.

Relief Valve . . .

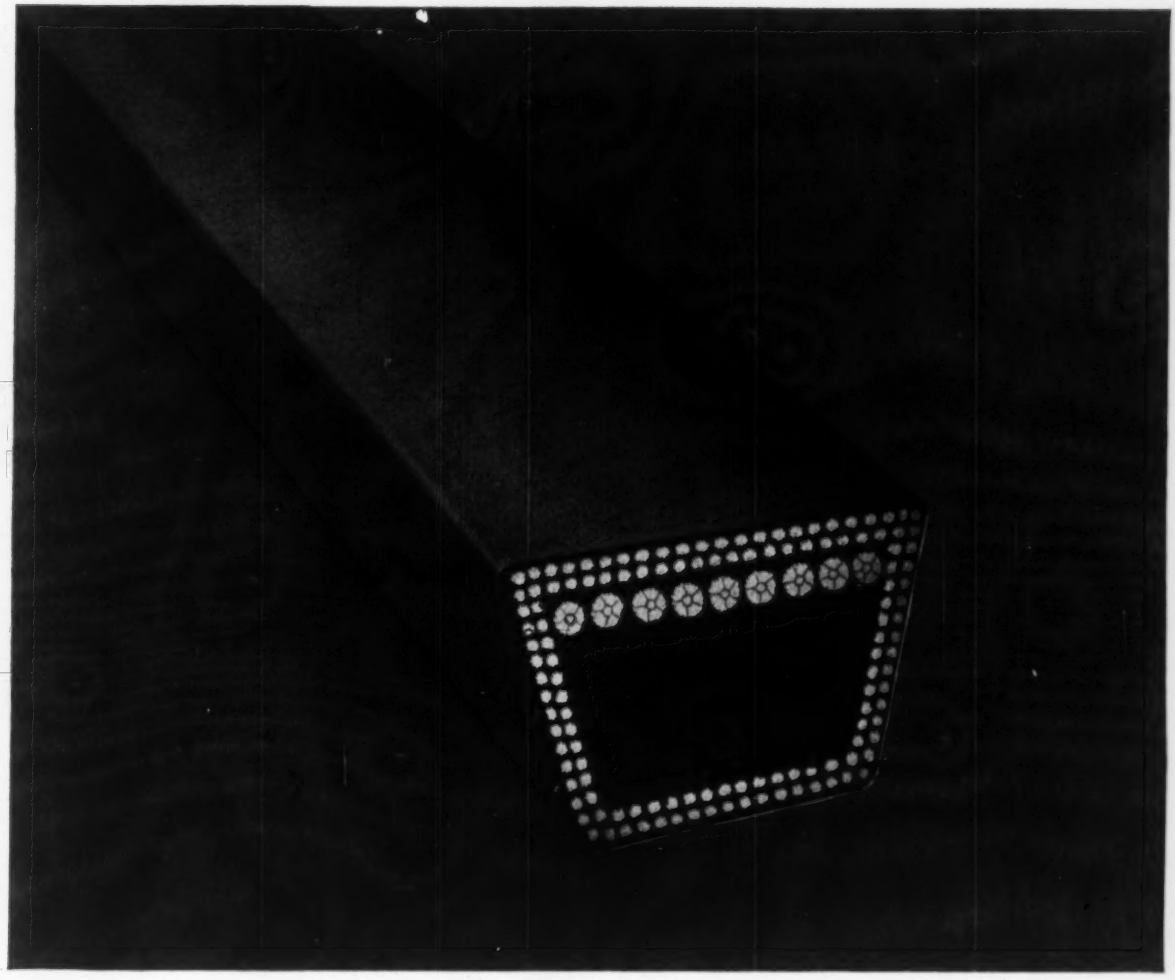
. . . in two new designs—*Watts Regulator Co., Dept. HPAC, 10 Embankment Rd., Lawrence, Mass.*

"No. 141S" equipped with lever and short thermostat; "No. 141X" equipped with lever and extension thermostat. Both have male inlet and ¾ in. female outlet connections. Valves are of all bronze construction, have steam pressure discharge rating of 1,028,000 Btu per hr at 125 psi setting and AGA temperature water rating of 750,000 Btu per hr.

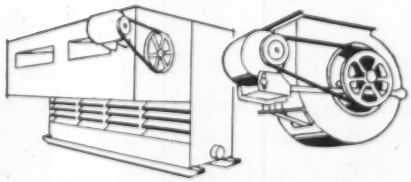
Portable Scaffold . . .

. . . designed to make elevated jobs faster, easier, safer—*Building Service Co., Dept. HPAC, 4923 18th Ave., S., Minneapolis* 17.

US RUBBER V-BELTS



Quiet . . . smooth . . . vibration at the vanishing point



Unerring electronic controls; new methods of curing; the facilities of the largest and most modern plant devoted exclusively to the manufacture of endless transmission belts—these are the factors that bring to the heating and air-conditioning industry the one V-belt that erases vibration to the vanishing point.

The U. S. V-belt contributes greatly to the silent and efficient operation of fans, pumps, compressors, blowers—large or small—wherever power transmission is required for air-conditioning and refrigeration units.

• • •

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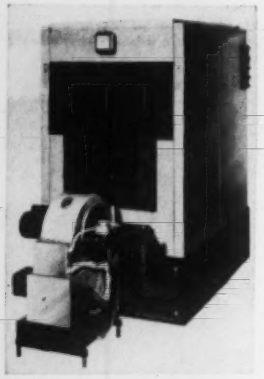
EQUIPMENT DEVELOPMENTS
Continued

Scaffold assembled from five parts: two ladder end frames with casters, two trusses, metal edged plywood platform. Set up on job, scaffold may be wheeled on its 4 in. ball bearing casters. Size of scaffold—29 in. wide, 6 ft 4 in. high, 6 ft long—permits wheeling through standard size door, says manufacturer.



Boiler-Burner Unit . . .

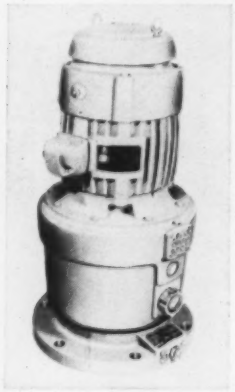
. . .for use with No. 4 and No. 5 fuel oil—*H. B. Smith Co., Inc., Dept. HPAC, 57 Main St., Westfield, Mass.*

"25J4" is new addition to company's "250 Series" cast iron water tube boiler, furnished as integral unit with burner, prefabricated combustion chamber, controls. Gun type oil burner used to preheat, then atomize oil before burning. Units available in four sizes with net steam ratings of 1950, 2275, 2600, 2925 sq ft respectively. Water boilers have equivalent ratings. Built-in tankless heaters supply to 12 gpm of hot water. Recommended for small commercial and industrial applications.

Two Range Meter . . .

. . .designed for measuring temperatures of gas, liquid, solids over two ranges—*Simpson Electric Co., Dept. HPAC, 5200 W. Kinzie St., Chicago.*

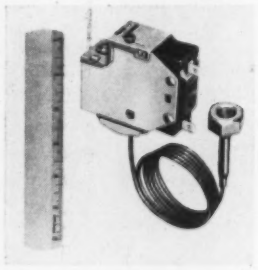
"Model 389-3L" measures low range from −50 to 100 F; high range from 100 to 250 F. Model accommodates three leads simultaneously with separate readings through one selector switch on front of instrument. Overall accuracy is ±3 F, and in center scale, ±2 F or better. Recommended by manufacturer for air conditioning, heating systems, other applications. Bulletin "4001" available from manufacturer describes unit.



Motors . . .

. . .designed to provide internally-geared power for industrial agitator applications—*U. S. Electrical Motors, Inc., Dept. HPAC, P. O. Box 2058, Los Angeles 54.*

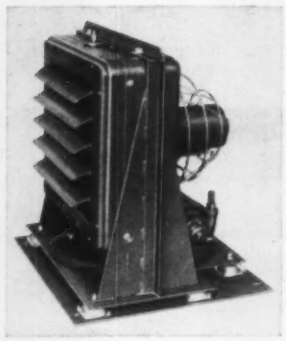
Vertical gearmotors rated 3 to 30 hp and 25 to 280 rpm, designed for mixing jobs such as processing of pigments, chemicals, foodstuffs, pharmaceuticals, clays. Three types of motor enclosures offered: "uniclosed," totally-enclosed, explosion-proof. Variable-speed "Var-drive" combination with unit also offered.



Limit Controls . . .

. . .developed for packaged commercial air conditioning—*Penn Controls, Inc., Dept. HPAC, Goshen, Ind.*

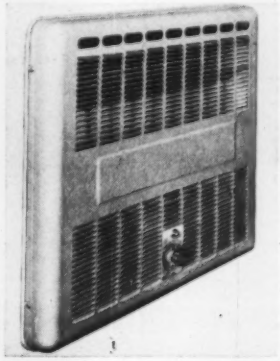
"Series 210" includes models for low, high or dual pressure, automatic or manual recycle. Patented power element provides for overrun pressures to 600 psig. Unit is compact, totally enclosed.



Fluid Cooler . . .

. . .developed specifically for cooling water cooled type electronic tubes—*American-Standard, American Blower Div., Dept. HPAC, Detroit 32.*

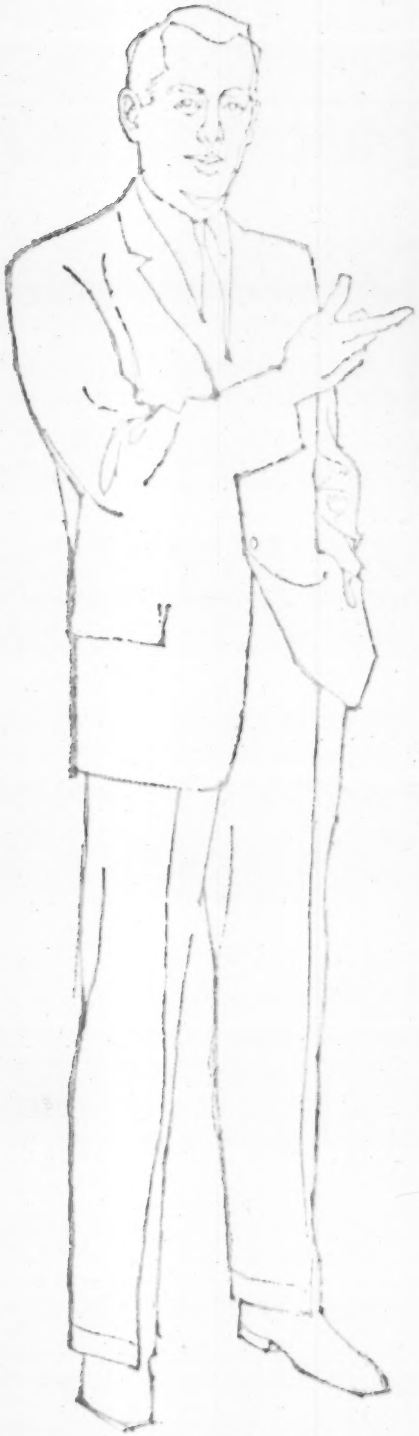
Unit consists of water type copper coil, motor driven fan and motor driven pump. Designed to occupy minimum space in electronic equipment installation. Model shown, "No. 89B155," capable of extracting 13,500 Btu per hr from water having minimum flow of 5 gpm with maximum water leaving temperature of 150 F and maximum ambient air temperature of 113 F. Requires space 24 × 32 × 27 in. for installation.



Electric Convectors . . .

. . .available in line from 500 to 3000 watts providing outputs of up to 10,246 Btu per hr—*Circle-Air Industries, Inc., Dept. HPAC, 244 Herkimer St., Brooklyn 16.*

Double wall construction with heating elements said to produce high rate of heat per kilowatt of electricity. Installed units protrude 2 in. Heating elements unconditionally guaranteed for five years. Temperature automatically controlled by built-in thermostat with pilot light.



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"Minimum installation time and costs are my responsibility. The dimensional accuracy of B&W Welding Fittings permits quick and positive welding with no erection delays."

Cutting costs is everyone's responsibility. In a piping system, using welding fittings that align accurately is one sure way of saving time and money — in installation and in maintenance. The dimensional accuracy of welding fittings like this B&W Ell assures you of trouble-free fabrication and installation. Their true circularity, full radius, and walls of uniform thickness will enable you to make your piping dollars go farther. Write for bulletin FB504.

B&W Welding Fittings and Forged Steel Flanges are available in carbon steel and the B&W CROLOYS.

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- **New Teflon Chevron valve stem packing**—no sticking, no leaking, no lubrication . . . ever!
- **New Monel valve stem**—super finished to prevent sticking!
- **New "Quick-Detach" stem fitting**—valve removable without disturbing adjustments!
- **New "MA" single seated valve**—for "dead-end" service!
- **All metal construction**—for long life!

Who builds today's *quality* regulators? The proof lies in New York City's more than 25,000 Fulton Sylphon Temperature Regulators . . . many still giving trouble-free performance after 25 years of service.

You can have this same premium performance in the pressure regulators you use in heating, ventilating and air conditioning systems.

The new No. 1073 Pressure Regulator gives you premium quality "extras" at no added cost. Installation is easy and inexpensive. Valve sizes up to 4" . . . pressures up to 250 psi.

WRITE FOR BULLETIN D-TH

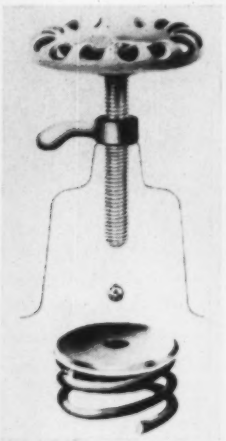
Mr. Controls®

Robertshaw-Fulton CONTROLS COMPANY

FULTON SYLPHON DIVISION • Knoxville 1, Tenn.

EQUIPMENT DEVELOPMENTS

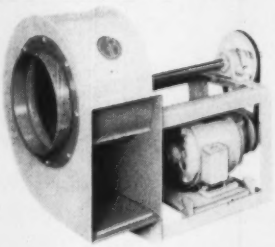
Continued



Pressure Reducing Valves

. . . with new handwheel and ball bearing adjusting screw assembly with finger-operated teardrop lock nut—*Jordan Industrial Sales Div. of OPW Corp., Dept. HPAC, 6013 Wiehe Rd., Cincinnati 13.*

New equipment standard on company's "Piloted" pressure reducing valves and optional equipment on standard pressure reducing valves. Ball bearing movement allows setting of control pressure without tools, eliminates torque force on main spring. Available in ½ to 2½ in. sizes, 250 psi in bronze and 125 psi in iron.

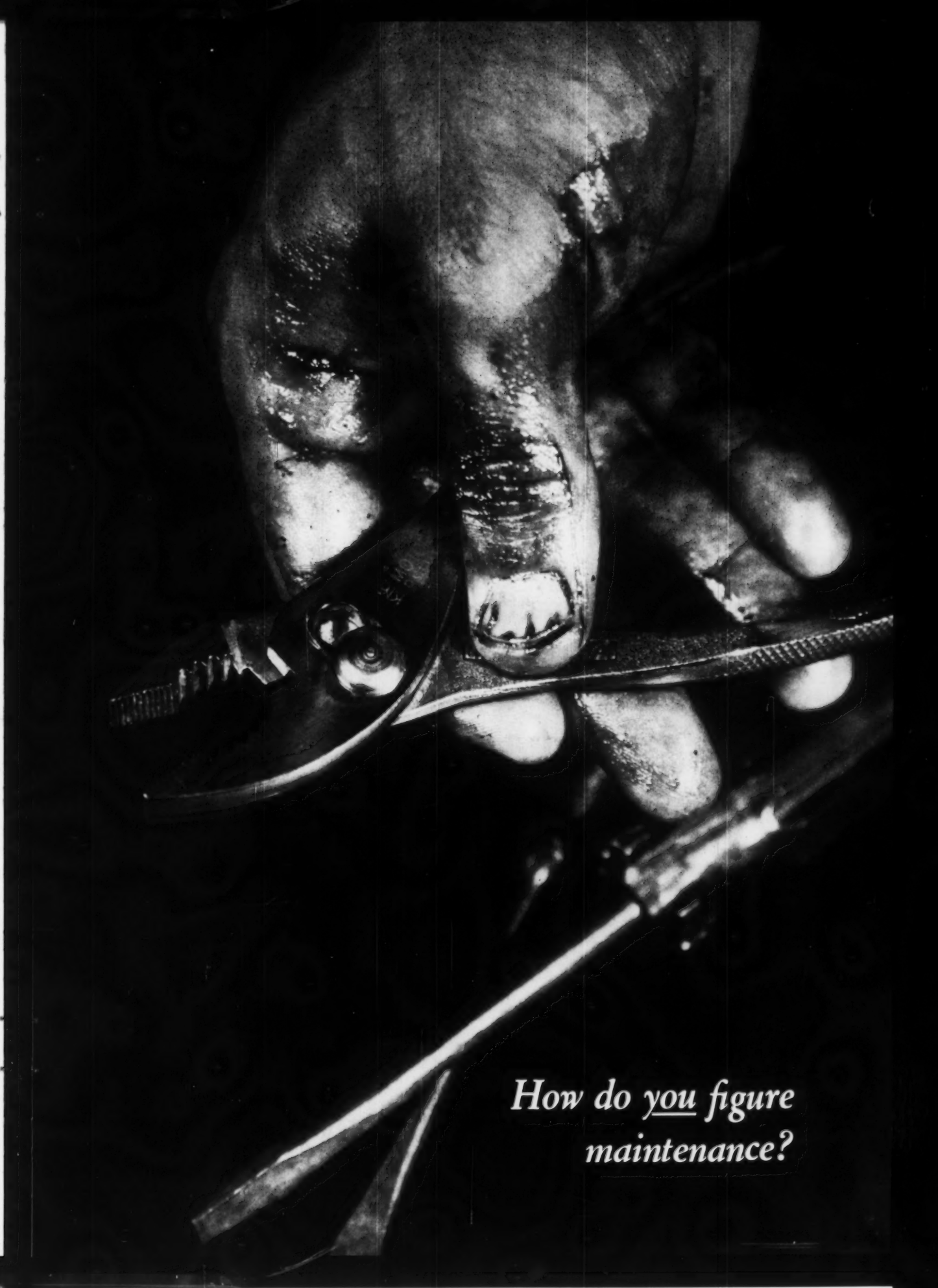


Exhaust Fans . . .

. . . designed to exhaust air from small, enclosed rooms, hoods and vats where gases and odors need to be removed—*General Blower Co., Dept. HPAC, Morton Grove, Ill.*

"Fan-Pac" units available either direct drive (8 models) or belt driven (2 models). Direct drive exhausters deliver up to 2290 cfm, belt driven models up to 1800 cfm. Standard finish is weather resistant, light acid resistant zinc chromate primer.

(*Continued on page* 181)


How do you figure
maintenance?

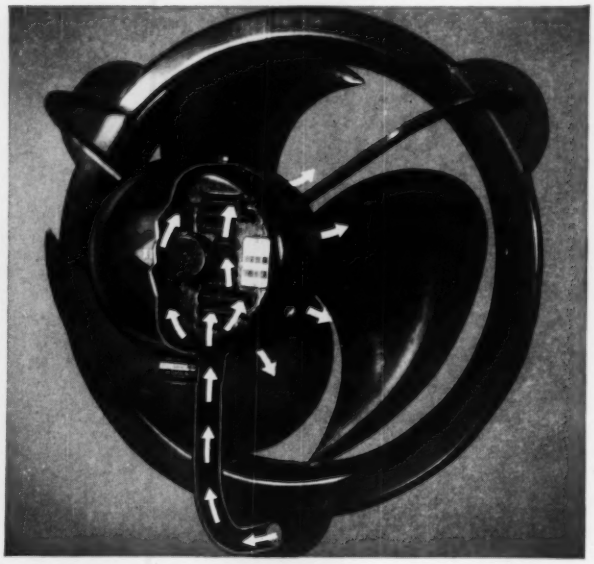
When it's ventilating equipment...

Just exactly what do *you* look for when you're after ventilating equipment? What features stand out in *your* mind as most important? What "makes" Quality Equipment, with a capital "Q"?

We wanted to know, so had an independent research organization conduct a nationwide survey among consulting mechanical engineers.

Here's why ILG *fans and cost so little to maintain,*

"X" Marks the Spot where the "traveling" mike is placed to pick up sound waves from this Ilg BC Airfoil Centrifugal Fan. Direct-connected Ilg-built motors eliminate the noisy slip and slap of belts and pulleys. In addition, Ilg Backward Curved Blades and airfoil design cut down eddy currents and turbulence for quieter operation.



How to Have Your Cake and Eat It. With Ilg Propeller Fans you get the operating cost advantages of *open-type* motors plus the protection of *totally enclosed* motors. Vent pipe brings in outside air to *pressure-cool* single-phase permanent-split capacitor and 3-phase motors. Casing protects motor windings against deposits. "One-Name-Plate" guarantee covers *both* fan and motor.

For fans built to satisfy your "specs"...

consulting engineers put low maintenance costs high on the list

What did we find out? That *low maintenance costs* were a primary consideration with about three out of every four consulting engineers.

A glance below will show some of the reasons why Ilg fans and ventilators *cut maintenance costs* to the absolute minimum. And don't overlook some of the *other* Ilg strong points preferred by consulting engineers; for example: quiet operation, vibration-free performance, low operating costs.

For further details of why Ilg rates so high with those who specify, send for Catalog No. 153 on propeller fans, Bulletin No. 257 on airfoil centrifugals, Bulletin Nos. 2301 and 2700 on power roof ventilators.

ILG *motors and ventilators operate so quietly*

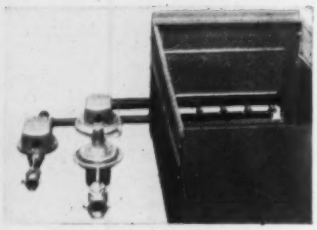
Last Look You'll Ever Have. Look now—because there's never any need to take an Ilg motor apart later. No centrifugal switches to wear or fail. Double-sealed, permanently lubricated ball bearings plus dynamically balanced moving parts assure smooth operation. Direct drive eliminates belt maintenance. Lower starting torque subjects permanent-split capacitor motor to less initial shock . . . lengthens motor life.

What's Inside Counts, Too. Beneath the lifetime aluminum housing of this low-silhouette Ilg Power Roof Ventilator purrs an Ilg-built motor direct-connected to the super-silent "Q"-type fan wheel. 11 sizes available. Choice of single-phase permanent-split capacitor or 3-phase motors.

specify ILG

ILG ELECTRIC VENTILATING COMPANY
2826 N. Pulaski Road, Chicago 41, Illinois
Offices in 57 Principal Cities
Member of Air Moving and Conditioning Association Inc. (AMCA)

HERE ARE THE *EXTRA VALUES* YOU'VE WANTED IN A COMMERCIAL GAS BOILER

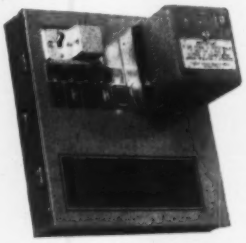


Dual Fuel Manifold and Base

Dual Fuel Control

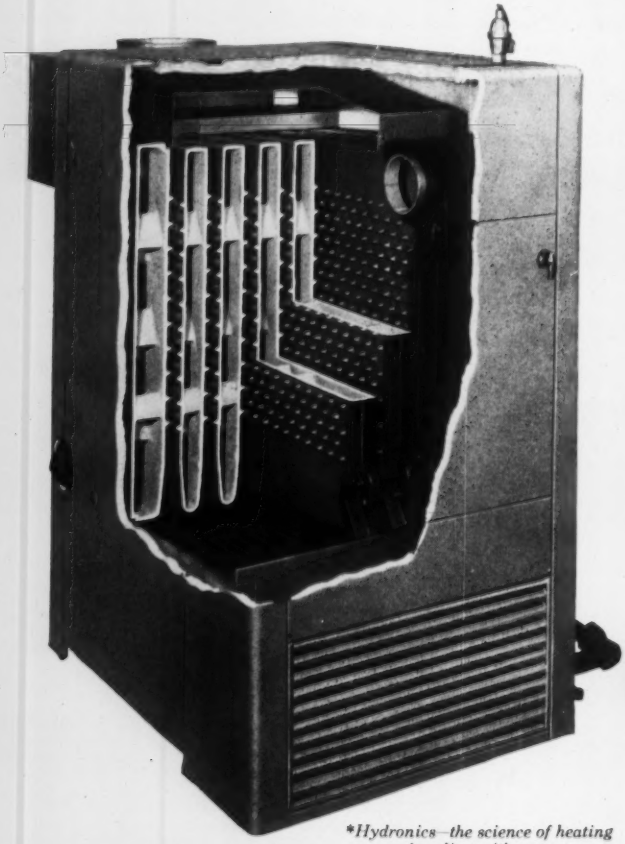
DUAL FUEL MANIFOLD—optional

This optional feature permits the "J" Boiler to operate on natural gas during normal load periods and change over to LP Gas for low temperature peak loads. Both gases are properly burned within the same combustion zone.



PRE-WIRED ELECTRONIC CONTROL PANEL—optional

The Weil-McLain Model "CP" is a complete gas boiler control system built into a compact panel, factory-assembled and tested. The panel reduces electrical work to a minimum—assures lower installation cost as well as correct operation of the boiler and its electronic safeguard controls.



*Hydronics—the science of heating and cooling with water.

To schools, apartments, commercial and industrial buildings, the Weil-McLain Type "J" Gas Boiler offers dependable hydronic* heating at low operating cost. It is designed in every detail to burn fuel efficiently and to absorb a maximum amount of heat.

Cast iron construction assures long life, with minimum repairs. The "J" Boiler is easy to maintain at top efficiency... simply pulling out the clean-out plates makes the spaces between the sections accessible for cleaning.

The compact design of this boiler permits installation in a small boiler room—saves in construction cost. It's faster to erect because short draw rods simplify installation—assure a strain-free assembly.

The Weil-McLain Type "J" Boiler, in capacities from 625,000 to 5,000,000 A.G.A. input BTU/hr., burns all gases automatically and safely.

Send for engineering data

WEIL-McLAIN

TYPE J GAS-FIRED BOILER

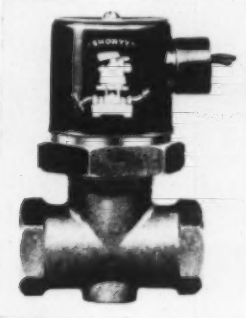
WEIL-McLAIN BOILERS · RADIATORS

WEIL-McLAIN COMPANY
MICHIGAN CITY, INDIANA

Address literature requests to Dept. AA-108.

EQUIPMENT DEVELOPMENTS

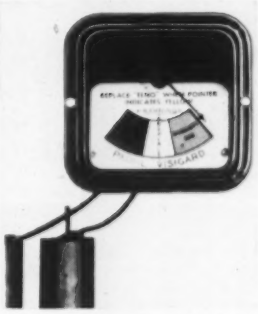
Continued from page 176



Solenoid Valve . . .

. . . in design 4¾ in. high by 3 in. wide with height from top to line 3 13/16 in.—*Atkomatic Valve Co., Inc., Dept. HPAC,* 545 *W. Abbott St., Indianapolis* 25.

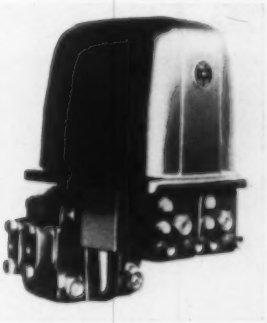
"Shorty" solenoid valve constructed of cast bronze with applications for air and gases to 250 psi, water to 150 psi, oil to 75 psi, steam to 25 psi. Pilot operated, valve can be kept open with pressure differential of 5 psi. Features cited: stainless steel pilot; unbreakable stick-free piston rings; replaceable resilient seats. Four pipe sizes: ¼, ⅜, ½, ¾ in.



Water Heater Protection

. . . designed to eliminate disassembly of water heater tanks for visual inspection of anodic rods—*Cleveland Heater Co., Dept. HPAC,* 2310 *Superior Ave., Cleveland* 14.

"Visigard" anodic signalling system has one moving part and is located on water heater jacket. Meter gives evaluation of anode's protectiveness. System actuated by galvanic current generated as anode performs function.



Pressure Transmitters . . .

. . . designed to measure and pneumatically transmit flow, differential pressure, level, specific gravity over wide ranges—*Bailey Meter Co., Dept. HPAC,* 1050 *Ivanhoe Rd., Cleveland* 10, *Ohio.*

Transmitters measure over minimum range of 0-2 in. water gage under services pressures to 50 psig to maximum span of 0-2000 in. WC under service pressures to 5000 psig. No viscous or other dampening devices are needed, says manufacturer. Stability is said to be maintained through newly developed reset type booster relay.

COMPLETE PACKAGE

SIMPLE INSTALLATION

LOW FIRE START

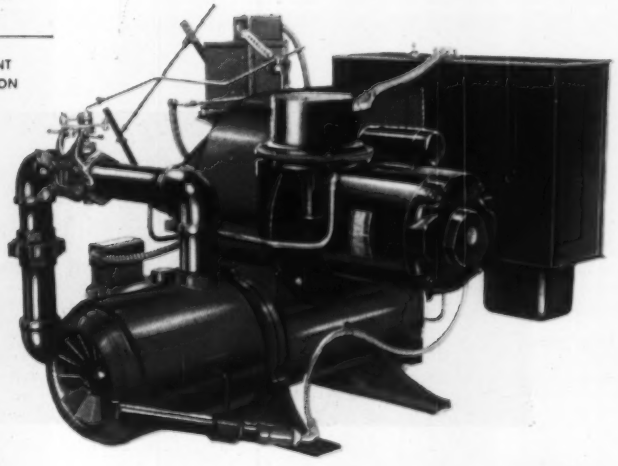
EFFICIENT OPERATION

FIRE TESTED

FULLY APPROVED

FACTORY GUARANTEED

HEV-E-DUTY POWER GAS BURNERS



Engineered for top performance under all weather conditions

Precision-engineered Hev-E-Duty power gas burners are the low-cost answer to high heating efficiency with gas. Automatic electric ignition assures safe starting. Built-in low fire start that builds up slowly to the flame size required means smooth, safe operation. Minimum low fire and maximum high fire can be controlled exactly for top efficiency with any boiler or furnace.

Once set, the burner maintains this setting automatically regardless of weather. Sizes from 720,000 to 21,000,000 BTU. Hev-E-Oil and combination gas/oil models also available. For more information write Industrial Combustion, Inc., 4507 N. Oakland Ave., Milwaukee 11, Wis., Dept. HPA-10.

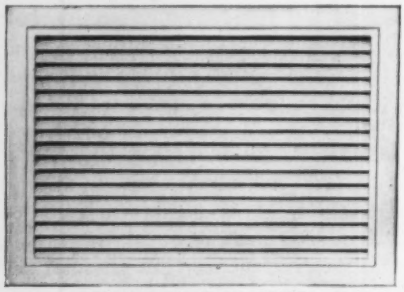
INDUSTRIAL COMBUSTION INC.

EXECUTIVE OFFICE: 4507 N. OAKLAND AVE., MILWAUKEE 11, WISCONSIN

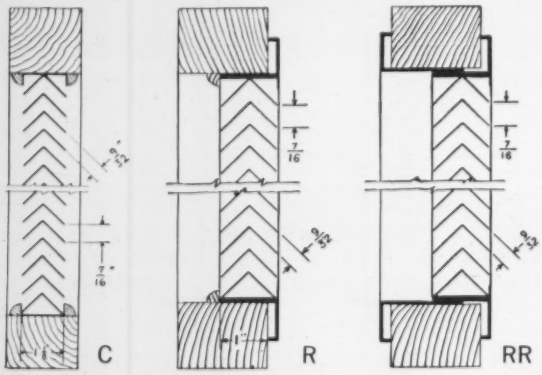
You can't see through

INDEPENDENT

NO-VISION GRILLES
for Doors, Walls and Partitions



No-Vision Grille No. 1312R



Where ventilation without vision is desired—in doors, walls and partitions—Independent No-Vision Grilles meet every requirement. It's impossible to see through an Independent No-Vision Grille from any viewpoint.

Independent No-Vision Grilles are made in three styles—Style C with grille core only, installed with molding as shown above; Style R with overlapping rim on all four sides of one surface of the grille; and style RR with a rim which is adjustable for door thicknesses of 1¼" to 2¼".

Independent No-Vision Grilles are made in 46 standard sizes for openings from 8" x 6" to 30" x 24". Additional sizes can be furnished on special order.

Send for Catalog

Write for Catalog No. 58—gives schedules of sizes, details and prices of registers and grilles for every purpose.

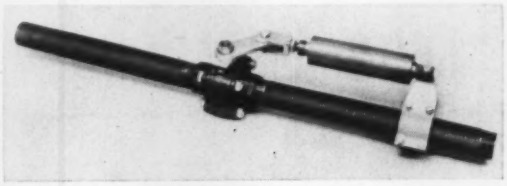
Always Leading—Always Progressing

THE INDEPENDENT REGISTER CO.

3747 E. 93rd STREET · CLEVELAND, OHIO

EQUIPMENT DEVELOPMENTS

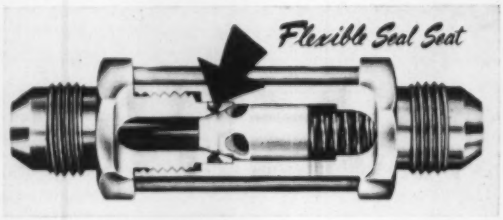
Continued



Air Cylinder Operator . . .

. . . designed for easier service in hazardous areas—*Worcester Valve Co., Inc., Dept. HPAC,* 16 *Parker St., Worcester* 10, *Mass.*

Air cylinder can be mounted on either side of pipe and on either end of valve. One or more valves can be controlled manually or electrically from central location, depending on requirements, specifications. Manual operation of valve is possible in event of air or electrical failure.



Check Valves . . .

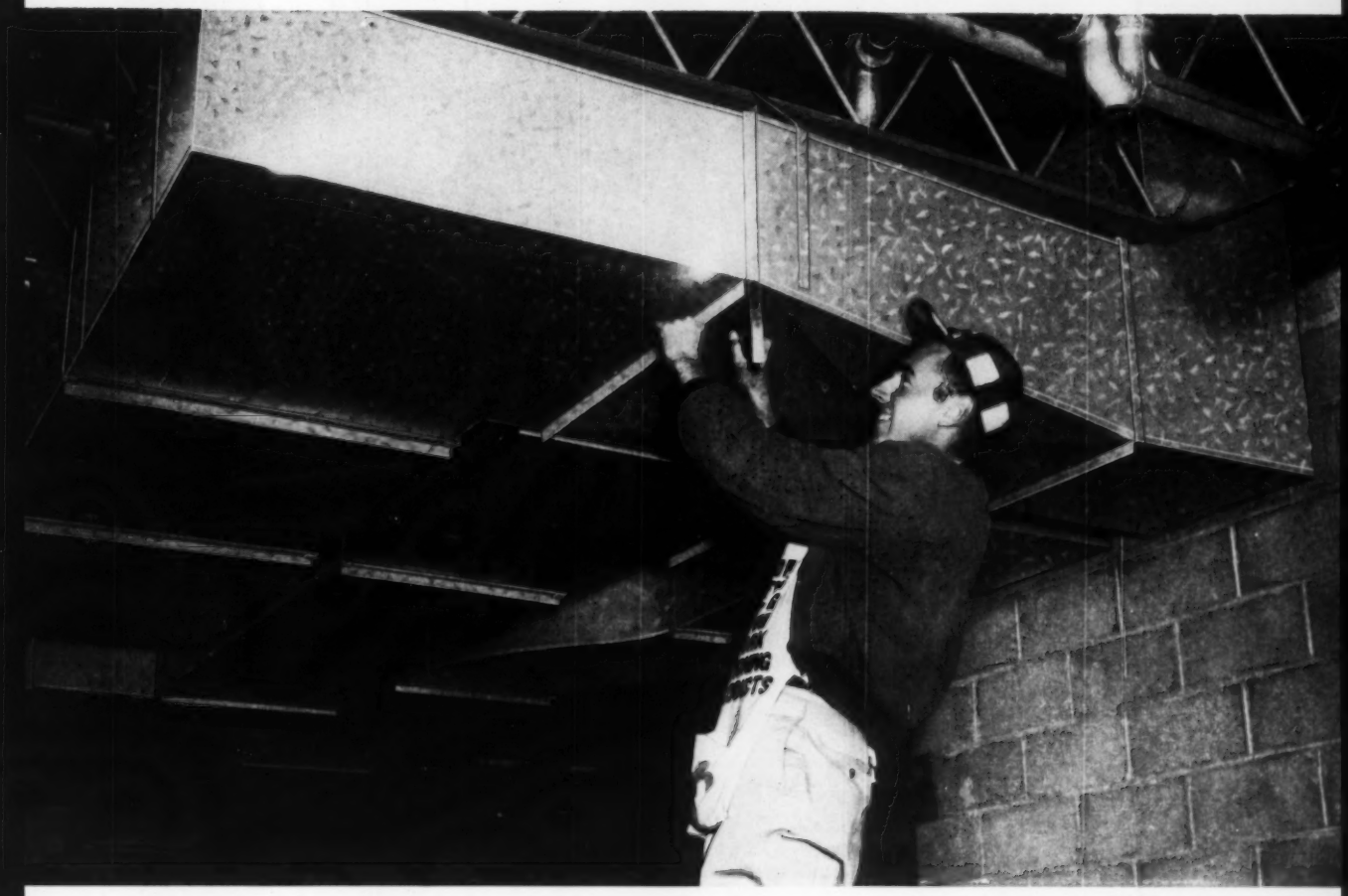
. . . engineered to withstand shock—*Kepner Products Co., Dept. HPAC,* 7301 *W.* 59*th St., Box* 407, *Summit, Ill.*

"Kep-O-Seal" valves available from stock in six standard pipe, tube sizes, 12 connection combinations. Valves will handle dirt, foreign particles without loss of positive sealing action and retain positive action at low pressure, says manufacturer. Also said to be free of vibration, chatter.

Brazing Flux . . .

. . . developed for silver brazing stainless, mild steel, copper, brass, wide range of alloys—*Air Reduction Sales Co., Div. of Air Reduction Co., Inc., Dept. HPAC,* 150 *E.* 42*nd St., New York* 17.

"Aircosil" flux available in 12 oz plastic squeeze bottle intended to pinpoint silver brazing flux. Top is removable so it may be refilled or water added to reduce consistency of flux.



Cut, form, hammer USS Galvanized Steel Sheets

—the zinc stays on

These are the galvanized steel sheets that take the sharp bends you see in the best-made ductwork. They're USS Galvanized Steel Sheets—strong, yet easy to form. USS Galvanized Steel Sheets *stay protected* because the zinc stays on. Cut, form, roll, hammer, lock-seam these sheets—no zinc flakes off the steel. Pride in your workmanship should be backed by the best of materials.

Why not make *your* ductwork with top-quality steel—use USS Galvanized Steel Sheets.

USS is a registered trademark

United States Steel Corporation—Pittsburgh
Columbia-Geneva Steel—San Francisco
Tennessee Coal & Iron—Fairfield, Alabama
American Steel & Wire—Cleveland
United States Steel Supply—Steel Service Centers
United States Steel Export Company

USS United States Steel

The Rabbit Who Had Only One Ear

Once upon a time ...

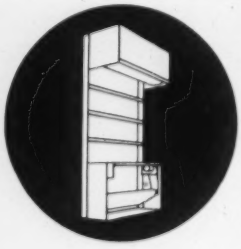
there was a rabbit who had a reputation as a very dumb bunny ... He listened to only one side of the story. He hadn't heard that Automatic Roll-Kleen Air Filters, handling millions of c f m, made by Farr Company were being installed all across the land.

One day his friendly Far-Air man pointed out the Roll-Kleen features. When he saw the 24-carrot quality of this filter, his good ear stood straight up ... (for quality is hard to hear even with two ears).

Now Mr. Bunny's clients multiply, for only maintenance-free Roll-Kleen will he specify.

Moral:

Compare before you specify. Hear all sides of the Automatic Filter Story. Nibble off the coupon below and mail it today.



FARR COMPANY

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FARR COMPANY
P. O. BOX 45187 AIRPORT STATION
LOS ANGELES 45, CALIFORNIA

Hop to it and send me the new Roll-Kleen Bulletin B-1400-2A today.

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TITLE _____

COMPANY _____

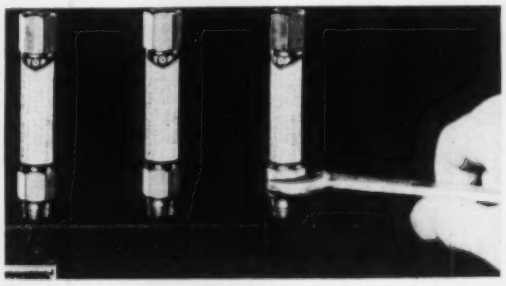
STREET ADDRESS _____

CITY & STATE _____

Lightwall Pipe Fitting . . .

. . . with extra length added to simplify connections by welding or flanging—*Horace T. Potts Co., Dept. HPAC,* 504 *Erie Ave., Philadelphia* 34.

"Speedline" stainless steel fittings designed to connect lightwall stainless pipe, Schedules 5 and 10. Permanent connections made by welding or brazing. When demountable joints are required, either or both ends of reducers can be expanded into flanges or unions for leakproof joint without welding, says manufacturer.



Manometer Check Valve . . .

. . . designed to prevent loss of indicating fluid under over-range condition—*Meriam Instrument Co., Dept. HPAC,* 10610 *Madison Ave., Cleveland* 2.

Check valve suitable for pressures to 500 psig, for use with all manometer indicating fluids, says company. Manometer response, accuracy said to be unaffected by valve. Maximum discharge permitted until instant indicating fluid enters valve. Plastic float causes closure of stainless steel valve. Unit measures 3¾ in. long, ⅝ in. diam. suitable for use on single-tube or on each tube of multiple manometers. Connections are ¼ in. NPT; female at top, male at bottom.

Stainless Steel Condenser Tubes . . .

. . . fabricated by welding from Types 316 and 304 stainless steel strip—*Chase Brass & Copper Co., Dept. HPAC,* 236 *Grand St., Waterbury* 20, *Conn.*

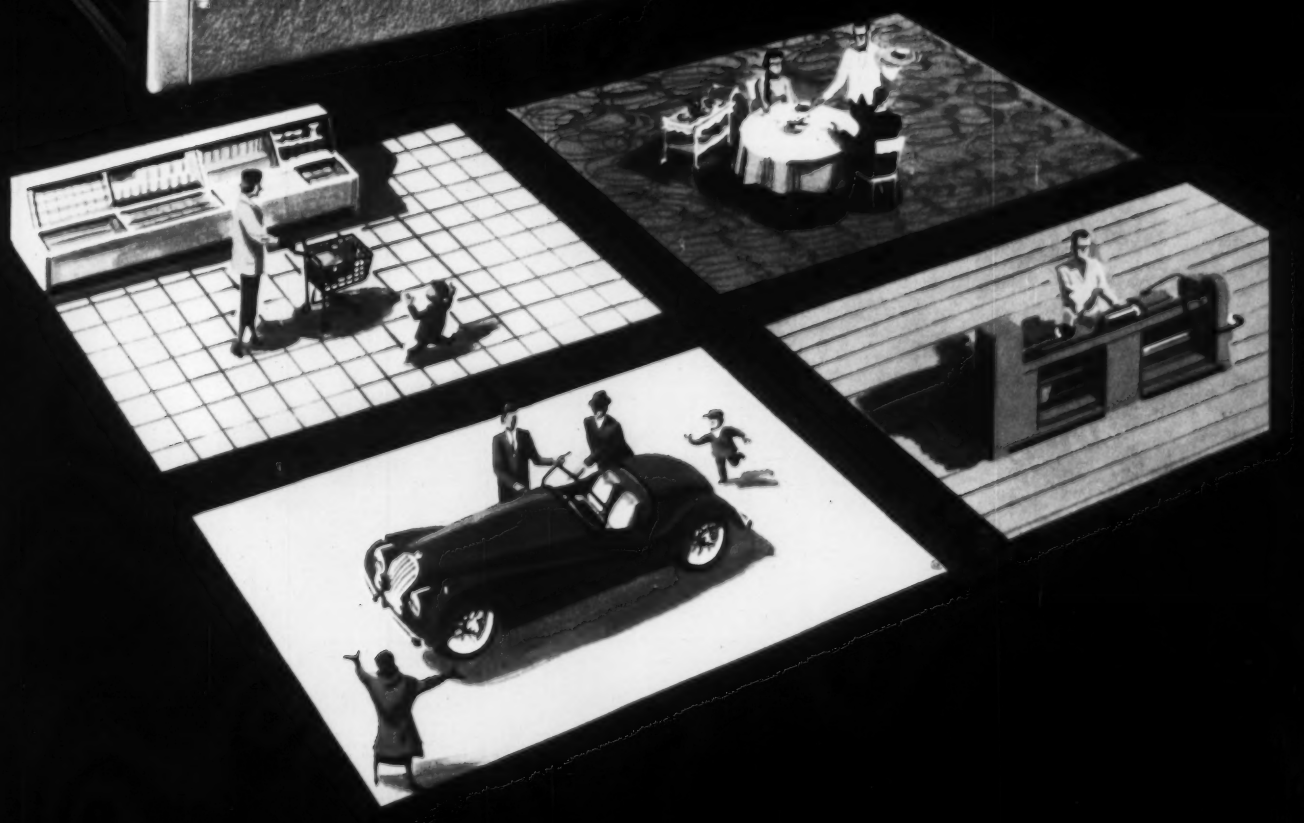
Stainless steel condenser tubes engineered for higher temperature, corrosion resistance, resistance to steam impingement. Both have long life in highly acidic waters. Type 316 recommended for use with high chloride concentrations.

the quality tells . . . the quality sells

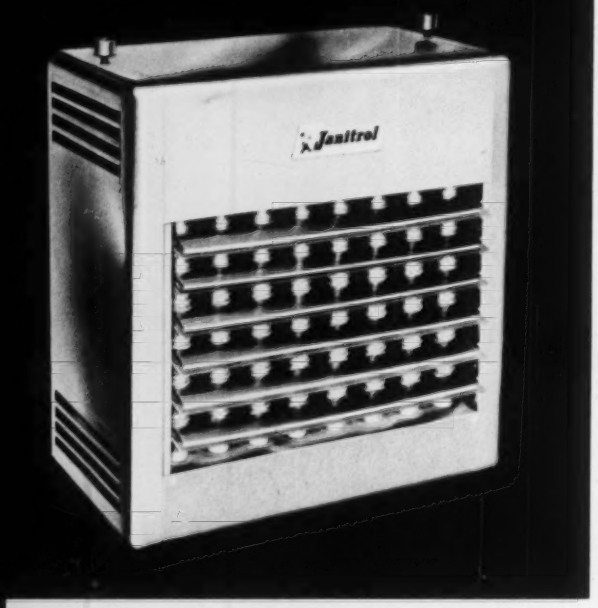
new

JANITROL

UNIT HEATERS



provide fast, clean heat for a variety of applications



Sell and Grow with JANITROL

Gas-fired Commercial and Industrial Heating Equipment

VERSATILE NEW JANITROL UNIT HEATERS

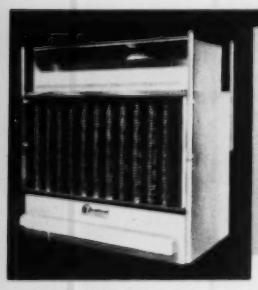
Remember this about Janitrol Unit Heaters: their versatility and efficiency, combined with low cost, means you can use them to advantage for most every commercial or industrial building.

They save installation time and labor. They do not need expensive duct work. They are completely automatic. They offer convenient "dual fuel" performance—use natural or LP gas; may be switched from one fuel to the other automatically. And they direct heat *where* needed only *when* it is needed—assure top operating economy.

And remember, too, that no other unit heater can match their record for durability and low maintenance. The exclusive Janitrol Multi-Thermex heat exchanger is so enduring that replacements for any cause have been less than ¼ of 1% in over two million heat exchanger tubes produced since 1940!

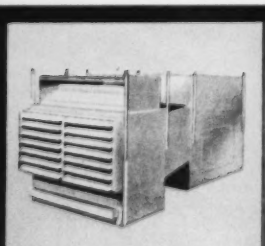
Dependability and economy—these are benefits that only time and experience can bring. Be sure Janitrol Unit Heaters are the choice for your next job.

Fill every commercial and industrial heating need from JANITROL'S broad line . . .



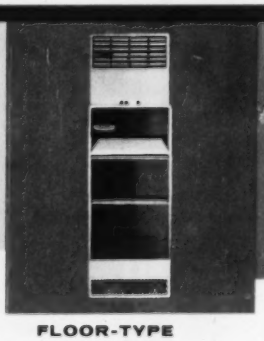
GAS-FIRED DUCT FURNACES

Engineered for installation in a duct where air is circulated by a separate blower. Especially adaptable for use in combination with cooling. Two sizes: 200,000 and 300,000 Btu/hr. input—may be combined to provide capacity from 200,000 Btu/hr. up, in increments of 100,000 Btu/hr. input. Five sizes, from 85,000 to 225,000 Btu/hr. in Duct 55 models.



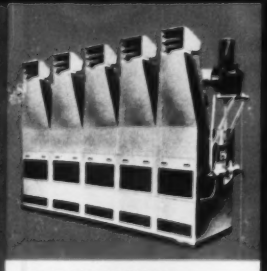
BLOWER-TYPE UNIT HEATER

Allows air delivery from greater heights and against greater static pressures. Models with exposed or enclosed blowers. A.G.A. approved as low and high static-type blower unit heater for air delivery to duct system up to 1.0 in. W.C. external static. Heat sections factory assembled. Sizes: 300,000, 400,000 and 500,000 Btu/hr. input.



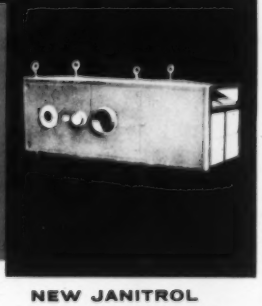
FLOOR-TYPE UNIT HEATER

Cold air drawn from floor level is heated, filtered and discharged horizontally overhead. Quiet, clean, carefree—ideal for offices, restaurants, stores, labs, etc., requiring a compact unit. May also be connected to a duct system. Six sizes: Rated input from 65,000 to 200,000 Btu/hr.



HEAVY DUTY BLOWER HEATERS

For unit heating, central heating and air conditioning. Wide range of standard blowers and motors assures correct air delivery and temperature rise in each application. Factory assembled and tested. Capacities from 250,000 Btu to 1,750,000 Btu/hr. input.



NEW JANITROL HORIZONTAL OIL UNIT HEATER

For suspension overhead. Saves floor space. Compact, efficient, low-maintenance design. May also be used to feed duct system. Sizes from 84,000 to 250,000 Btu/hr. output.

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Write today for complete information on heating with gas in buildings of every type. There's no obligation.

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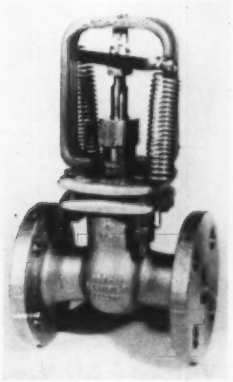
HEATING AND AIR CONDITIONING DIVISION

Surface Combustion Corporation, Columbus 16, Ohio

In Canada: Moffat Heating & Air Conditioning Division Moffats, Ltd., Toronto, 15

Also Makers of Surface Industrial Furnaces, Kathabar Humidity Conditioning, Janitrol Residential Heating and Cooling Equipment

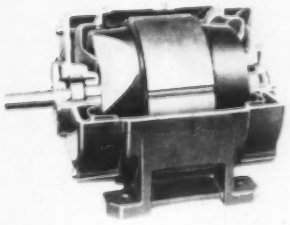
EQUIPMENT DEVELOPMENTS
Cont'nued



Gate Valve . . .

. . . for fire protection cutoff applications—*Cooper Alloy Corp., Dept. HPAC, Bloy St. and Ramsey Ave., Hillside, N. J.*

Valve is designed to handle wide range of corrosive flammables and requires neither counter-weights nor interior bellows. Valve is modified bolted bonnet gate valve held open against two exterior springs by small fusible link. Springs snap valve shut when fusible link reaches melting temperature of 160 F, preventing flow of liquid to fire areas. Available in alloy Types 304, 316, FA-20, nickel, in sizes ½ to 2 in.

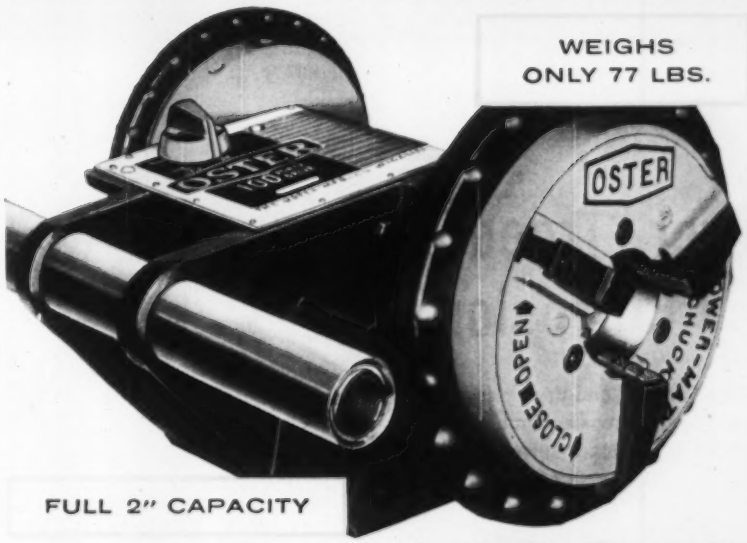


Motor . . .

. . . with open-type motor stators cast in epoxy resin—*Allis-Chalmers Mfg. Co., Dept. HPAC, 1171 S. 70th St., Milwaukee 1.*

Motor applications include severe conditions of outdoor service or where moisture or contaminated atmospheres destroy effectiveness of conventional insulation system. "Super-Seal" epoxy resin encapsulation will be available in all integral horsepower frame sizes in which random-wound coils are used.

BIGGEST NEWS IN POWER THREADING!



Only $199.50

lowest price in the industry... for the all-new OSTER "100" POWER PIPE MACHINE

. . . complete with NEW "POWER-MATIC" FRONT CHUCK including REPLACEABLE INSERT CHUCK JAWS . . . SELF-CENTERING REAR CHUCK . . . POWERFUL HEAVY-DUTY REVERSIBLE MOTOR.

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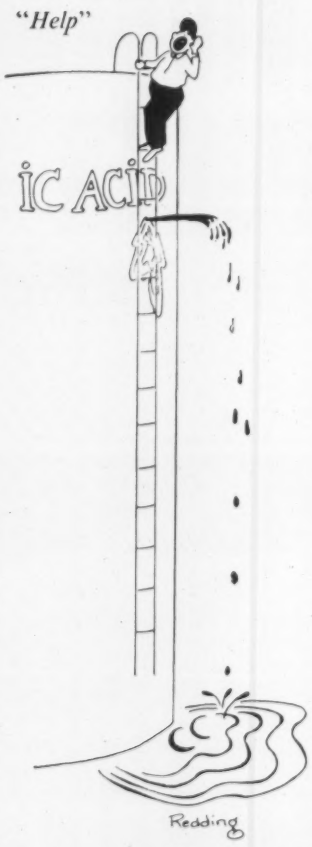
THE OSTER MANUFACTURING COMPANY • 1347 East 289th St., Wickliffe, Ohio

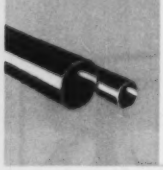
Life in these excited states...



Ever "Treed" by Corrosion?

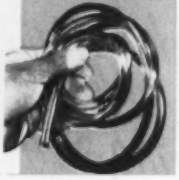
Ever left high and dry by corrosion . . . sweating out repairs, shut-downs, wasted materials? You can solve 85 to 100% of these problems once and for all with Ace chemical resistant piping, valves, pumps, tanks and other equipment. It doesn't *cost* . . . it *pays*.

TEMPRON *for hot jobs*



Best non-metallic pipe anywhere for *hot* chemicals to 275°F. Also handles tough organics. Rigid, tough nitrile. Pipe and fittings to 8". *Bul. 96A.*

ACE-FLEX . . . *sparkling clear*

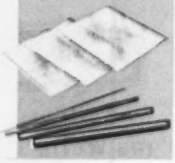


1001 uses. Non-toxic, odorless, tasteless, sterilizable, flexible tubing. Excellent for chemicals, foods, and for lab or machine lines. ⅛ to 1¼". *Bul. 66.*

"BONDED STORAGE" *for corrosives*

Heavy Ace rubber and plastic tank linings unexcelled for alkalies, acids, bleaches, salts. Faultless seams, indestructible bond, shock and age-resistant. All shapes. *Bul. CE-53.*

DO-IT-YOURSELF PLASTICS



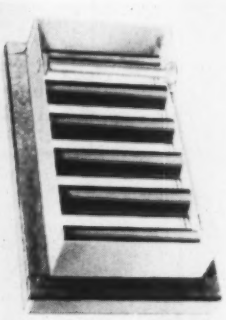
Special equipment often can be machined, punched or welded of standard plastic or hard rubber sheet, rod or tubing. Write for details today.

ACE processing equipment of rubber and plastics

AMERICAN HARD RUBBER COMPANY
DIVISION OF AMERACE CORPORATION
Ace Road • Butler, New Jersey

EQUIPMENT DEVELOPMENTS

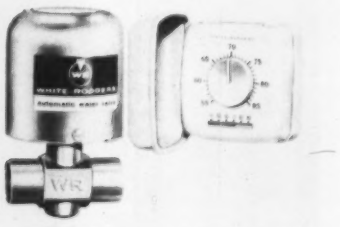
Continued



High Velocity Air Valve . .

. . .composed of gang operated, neoprene vane sections—*Barber-Colman Co., Dept. HPAC,* 1300 *Rock St., Rockford, Ill.*

Valve said to provide simple positive control of velocities, pressures, assure linear control of air volume. "Model R" can be used in single duct systems to control velocities, balance system; or in double duct applications to mix hot, cold air and control velocities. Information contained in catalog "No. F-8752."



Zone Control . . .

. . .developed to provide multiple zone control using one circulator and one relay—*White-Rodgers Co., Dept. HPAC,* 1209 *Cass Ave., St. Louis 6.*

Thermostat and small motorized water valve maintain desired temperature in each zone, eliminating need for extra circulators, relays, flow control valves, says manufacturer. Valve is slow opening and of rotary self-cleaning design, operated by low voltage. Valve only draws current during opening and closing, requires no current to hold in open position. Valve is 3 × 5½ in. in size. Control packages available with valves of ¾, 1, 1¼ in. pipe sizes.

(*Continued on page* 192)

SPECIFY COPPER TUBE AND PIPE MADE THE QUALITY WAY . . .

MADE IN U.S.A.

BECAUSE:

- You are assured of *consistent* quality time after time.
- You support your fellow American workers.
- You help build your reputation and America's prosperity.
- You can count on a reliable source of supply.

TYPES K, L, M, DWV,
COPPER AND BRASS PIPE

The All-American Line From Mine to Market

PHELPS DODGE COPPER WATER TUBE

- Highest grade copper from Phelps Dodge's own mines.
- Controlled quality assures unsurpassed tube properties, including precise uniformity of wall thickness.
- Color-coding of straight-length tubes for instant identification.
- Packaging that's easy to stock, easy to use.
- Mill depots strategically located for speedy service.

Quality tube sold the Quality way — through wholesalers

PHELPS DODGE COPPER PRODUCTS CORPORATION

NEW YORK, N. Y. • LOS ANGELES, CALIF.

MADE IN U.S.A. TO THE STANDARDS OF AMERICAN INDUSTRY

UNION
CARBIDE
Ucon
BRAND
refrigerants

Coming soon...

Ucon

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refrigerants

Important News For the Refrigeration and Air Conditioning Industries...

UCON Refrigerants will be dry, pure, top quality

With UCON Refrigerants you will get quality that meets the highest industry standards. And you can choose from five grades, UCON 11-12-22-113-114.

But you'll get more. Much more.

Personal Service from technically trained representatives. The UCON Refrigerants service force is the largest in the United States.

Full Choice of Unit Sizes to meet your needs. UCON Refrigerants will be available in 10, 25, 145 lb., or ton cylinders; truck-tank or tank-car quantities.

Prompt Delivery from the largest network of distribution points serving America's refrigeration and air conditioning industries.

America's newest fluorocarbon plant will bring you a UCON Refrigerant for your air conditioning and refrigeration application. And there are new, exciting developments, soon to come. For full data write UCON Refrigerants, Union Carbide Chemicals Company, Division of Union Carbide Corporation, 30 East 42nd Street, New York 17, New York.

"Ucon" and "Union Carbide" are registered trade marks of Union Carbide Corporation.

UNION CARBIDE

Ucon

BRAND refrigerants

These 5 UCON Brand Refrigerants will meet your refrigeration and air conditioning needs

UCON Refrigerant 11 Trichloromonofluoromethane
UCON Refrigerant 12 Dichlorodifluoromethane
UCON Refrigerant 22 Monochlorodifluoromethane
UCON Refrigerant 113 Trichlorotrifluoroethane
UCON Refrigerant 114 Dichlorotetrafluoroethane

UNION CARBIDE CHEMICALS COMPANY *Division of Union Carbide Corporation*

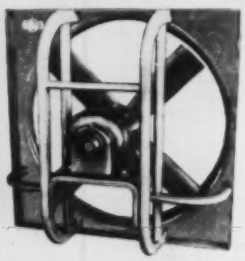
EQUIPMENT DEVELOPMENTS

Continued

Heavy Duty Thermostat . .

. . .with increased non-inductive ratings for electric heating applications —*Penn Controls, Inc., Dept. HPAC, Goshen, Ind.*

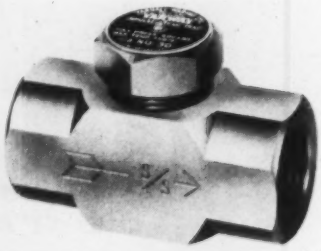
"Type 876" thermostat intended for use controlling heater and industrial space heating equipment. Supplied with standard range of 40 to 80 F, and adjustable differential from 2 to 7½ F.



Propeller Fan . . .

. . .engineered to operate at water gage exceeding 0.2 in. under severe conditions of dust, dirt, smoke, steam —*Power Line Fan Co., Subsidiary of Chelsea Products, Inc., Dept. HPAC, 639 South Ave., Plainfield, N. J.*

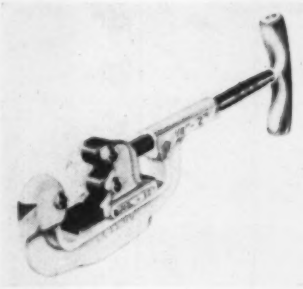
"DP Series" equipped with non-overloading, cast aluminum airfoil type propellers, totally enclosed ball bearing motors. Have all steel welded frame with one-piece heavy gage steel orifice, panel, supported by U-channel back braces.



Impulse Steam Trap . . .

. . .engineered for light condensate load applications—*Yarnall-Waring Co., Dept. HPAC, 107 Mermaid Ave., Philadelphia 18.*

Lever type valve pivots about fulcrum, discharges air, condensate at full capacity at startup time and snaps shut when steam reaches trap. Features cited: replaceable valve-seat assembly; only one moving part; stainless steel construction. Available in ½ in. size only for operating pressures 8 to 600 psig.



Pipe Cutters . . .

. . .designed to give cleaner, straighter cuts—*Toledo Pipe Threading Machine Co., Dept. HPAC, 1445 Summit St., Toledo 4.*

Improvements in new line of pipe cutters include high-alloy steel cutting wheel, new sliding block construction, replaceable slide plate, longer shank to protect threads. Available in four models: "No. 10,"

ELECTRIC HOT WATER HEAT

PRECISION

ELECTRIC HOT WATER GENERATOR

Complete Unit Ready for Installation. Precision Electric Hot Water Generator comes complete with water circulator, heating elements & thermostats.
No ducts! No noise! No chimney! No odors! No flame! A complete heating plant ready for electrical and heating contractor.

Use With Any Type Hot Water Heating And Water Chiller For Year-Round Air Conditioning. . . Baseboard, floor or ceiling coils, convector, cast-iron radiators. Suited for new or old homes, churches, apartments, hotels, motels, hospitals, commercial buildings and swimming pools. Supplies hot water at temperatures ranging from 60 to 190 degrees. Ideal for auxiliary heating system where rooms are added.

Every Unit Inspected And Tested. 10 years of trouble-free service in actual installations.

9 Stock Sizes. 40,948 BTU to 204,720 BTU output. Larger units also available. Largest stock unit requires only 16" x 38" floor space x 32" high.

These Units Meet The Requirements Of The ASME Boiler And Pressure Vessel Code.

Write for FREE color brochure and prices.

PRECISION PARTS CORPORATION

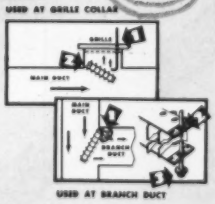
400-HP&AC North First Street • Nashville 7, Tennessee

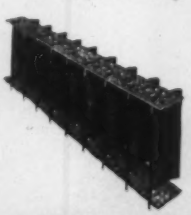
Another CAIN'S COIL OF PROFIT

SCOOP-RAIL

ELIMINATES

- Radius ell, transition, and splitter damper at branch duct take-offs.
- Volume damper on grille.
- Special keys, wrenches, etc., for volume adjustment.
- Job delay in ordering.





SCOOP RAIL, most economical method devised for fabricating precision, adjustable air scoops for branch ducts and grille collars insuring uniform air distribution across branch duct or over entire face of grille. 50 speed nut tabs for ¾" square rod in each carton.

Union Made

SOLD ONLY THROUGH JOBBERS AND DISTRIBUTORS
Some Territories Open for Manufacturers Agents Calling on Jobbers and Distributors

CAIN MANUFACTURING CO.

1111 North 5th Avenue Phone FA 2-0354 Birmingham, Alabama

ANOTHER

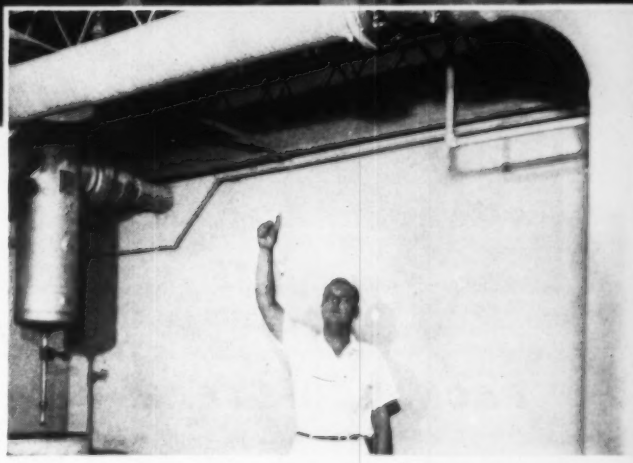
SPANG®

CW STEEL PIPE

INSTALLATION

Glazing operation requires both water and compressed air. 4,000 ft of SPANG Pipe comprise water lines, 1,000 ft carry compressed air.

Dewey W. Hall, Hall Plumbing & Heating Co., inspects the compressed air system at Stylon Southern Corporation. 5,000 ft of Spang Steel Pipe, in sizes from ¾" to 12", were installed at Stylon Plant No. 2.



Dependable past performance creates second SPANG® Steel Pipe order at Stylon Southern Corporation

The new $2,000,000 Plant No. 2 of Stylon Southern Corporation at Florence, Alabama contains 5,000 ft of SPANG Steel Pipe to carry water and compressed air for the manufacturing of ceramic tile.

"With the new plant's capacity calling for the production of eight million square feet of ceramic tile a year, we must have reliable air and water piping to produce at this rate and operate efficiently," reports Mr. Robert C. Jackson, Plant Engineer.

"Based on our experience with a similar SPANG Pipe installation at our Plant No. 1 in 1954, we chose SPANG again for its dependability. The new installation, put into use in July, 1956, has performed perfectly."

Produced in a complete range of styles, sizes and colors, Stylon Ceramic Tile is used for walls, floors and counters in home and commercial applications. Combined, Plants No. 1 and No. 2 produce 15 million square feet of ceramic tile yearly. And SPANG Pipe plays a vital part in maintaining this production.

QUALITY CONTROL PROVIDES DEPENDABILITY

SPANG Steel Pipe is *quality-controlled* from skelp to finished product. Each lot is tested and inspected to bring you *top-quality* pipe that is easy to cut, bend and weld. There's a SPANG Distributor near you. Let him serve you on your next piping job.

Architect: Turner & Northington, Florence, Ala.
General Contractor: Brice Construction Company, Birmingham, Ala.
Piping Contractor: Hall Plumbing & Heating Company, Florence, Ala.
Spang Distributor: Tallman Supply Company, Florence, Ala.
Mechanical Engineer: Robert C. Jackson.

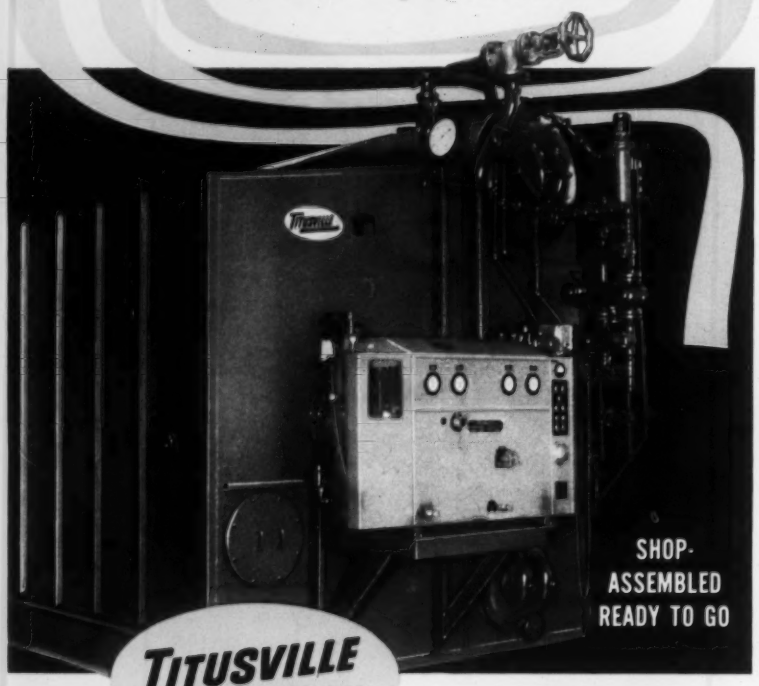
SPANG-CHALFANT SPANG® CW STEEL PIPE

DIVISION OF THE NATIONAL SUPPLY COMPANY

General Sales Offices:
Two Gateway Center, Pittsburgh, Pa.

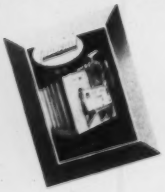
District Sales Offices: Atlanta, Boston, Detroit, Houston, Los Angeles, New York, Philadelphia, Pittsburgh, St. Louis

10,000 pounds
to 60,000 pounds
of quality
steam per hour



TITUSVILLE
BOILERS SINCE 1860

TYPE WTP
PACKAGED STEAM GENERATOR



Write for your copy
of new Bulletin B-3255

The Titusville WTP Steam Generator's ease of installation and simplicity of operation are matched by the economy and dependability in operation that make this water-tube unit a standout in value year after year! Completely shop-assembled, requiring no special foundations, high stack or induced draft fan, the Titusville WTP is ready to serve you the moment service connections are made. *Let us discuss your needs.*

THE TITUSVILLE IRON WORKS CO.

BOILER DIVISION
BOILERS for Power and Heat . . . High and Low Pressure . . .
Water Tube . . . Fire Tube . . . Package Units

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Crystallizers . . . Direct Fired Heaters . . . Evaporators . . .
Heat Exchangers . . . Mixing and Blending Units . . . Quick
Opening Doors . . . Special Carbon and Alloy Processing
Vessels . . . Synthesis Converters

FORGE DIVISION
Crankshafts . . . Pressure Vessels . . . Hydraulic Cylinders . . .
Shafting . . . Straightening and Back-up Rolls

A Division of
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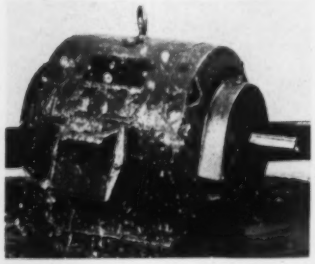
TITUSVILLE, PENNSYLVANIA
Manufacturers of A Complete Line of Boilers for Every Heating and Power Requirement
Plants at Titusville, Pa. and Warren, Pa.
Offices in Principal Cities

EQUIPMENT DEVELOPMENTS
Continued

1/8 to 1 1/4 in.; "No. 20," 1/8 to 2 in.; "No. 201," 1/8 to 1 1/4 in.; "No. 202," 1/8 to 2 in. "No. 201" and "No. 202" have extra wide rollers, can be used by hand or with power.



Weatherproof Motor . . .

. . . intended for use in outdoor applications where resistance to moisture and weather is required—*Reliance Electric and Engineering Co., Dept. HPAC, 24701 Euclid Ave., Cleveland 17.*

Open motor exceeds NEMA splashproof requirements; all external parts are of corrosionproof cast iron construction and shaft openings are sealed by shaft cap and slinger. Features cited include: waterproof insulation; silicone sleeves; glass-mica slot liners.

Piping Paint Applicator . . .

. . . developed for painting pipes, contoured, irregular and hard-to-reach surfaces—*Bestt Rollr Co., Dept. HPAC, 160 S. Brooke St., Fond du Lac, Wis.*

Painter's mitt said to be relatively lint free and is made of lambskin. Offered in two styles: with or without thumb. Painting side of mitt is dipped lightly into paint, applied to surface by shaping hand to adapt to contour of object painted. No pressure required.

For piping systems that can't be anchored, use ZALLEA HINGED EXPANSION JOINTS

Piping systems like the one in this 63,750 bbl/day catalytic cracking unit, one of the world's largest, at Gulf Oil Corp. Girard Point Refinery, have to be entirely self supporting. The entire cracking unit . . . reactor, regenerator and all connecting lines . . . is suspended in a huge structural steel framework, counterweighted to keep the system in balance, and fitted with Zallea Hinged Expansion Joints to provide vital flexibility plus support for the reactor.

In the 150 ft. air supply line, all thermal movement of the piping is absorbed by angular displacement in three 42" dia. Zallea Hinged Expansion Joints. Start-up air in this line is at 1000°F. Under operating conditions it is delivered at 250°F, 25 psig.

Two 50" dia. Zallea Hinged Expansion Joints in the spent catalyst line carry fluidized cracking catalyst at 950°F, 13 psig.

Since this cracking unit first went on stream, these Zallea Expansion Joints have given completely trouble-free service.

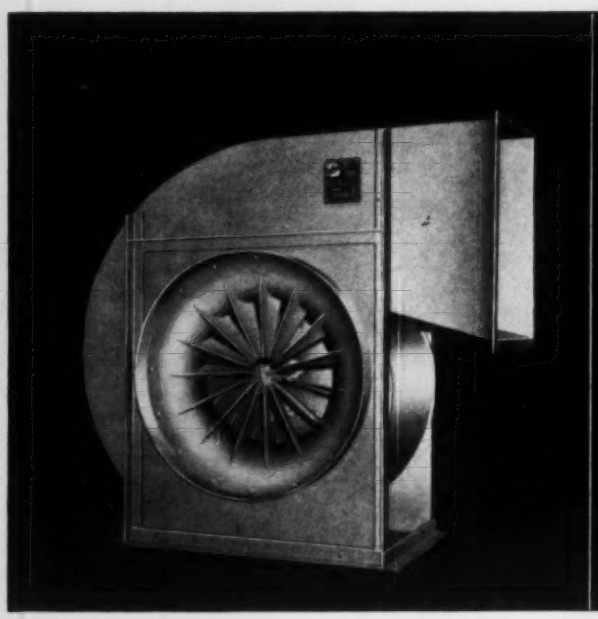
Process piping of any kind can be fully protected with one or more Zallea Expansion Joints. From the complete Zallea line you can select the expansion joint or combination of expansion joints best suited to your particular problems.

Get the complete story in our new 72-page manual. Write today, on your company letterhead, for your copy of Catalog 56. Zallea Brothers, 81 Locust Street, Wilmington 99, Delaware.

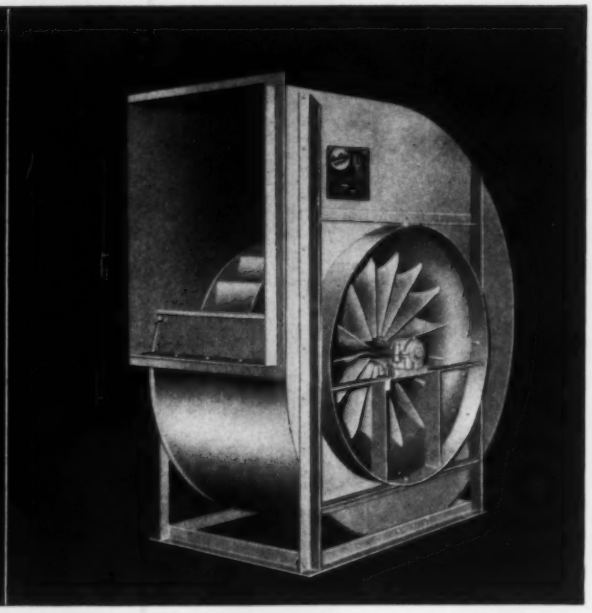
Zallea expansion joints

Zallea Brothers • Wilmington 99, Delaware

World's largest manufacturers of expansion joints



For Classes III-IV (High Pressures) The "Buffalo" Type "BLH" Fan



For Classes I-II (Moderate Pressures) The "Buffalo" Type "BL" Fan

FOR THE BEST ENGINEERED JOBS, SPECIFY BUFFALO "JOB-SUITED" FANS

For central system applications you don't have to accept a "compromise fan", loosely designed to cover any and all pressure requirements. "Buffalo" builds *two* fans, each engineered to fulfill specific pressure requirements to the highest possible degree. Brief engineering details on these "no compromise" "Buffalo" Fans are given below.

The "Buffalo" Type "BLH" Fan is recognized by engineers and contractors alike for its outstanding performance in Classes III and IV service. The "BLH" maintains an extremely high mechanical efficiency of 86% over a broad operating range. The smooth inlet bell with matching shroud, directional inlet vanes, backward-curved blades and divergent outlet all contribute to quiet operation and minimum turbulence. "Buffalo" engineering features, plus husky construction, add up to an efficient high pressure fan that will deliver long, faithful, maintenance-free service. When you plan a conduit system or other Class III-IV installation, be sure to specify the "BLH". Call in your "Buffalo" representative or write for Bulletin F-200.

The "Buffalo" Type "BL" Fan has gained wide acceptance for peak performance in major Class I and II installations throughout the country. Non-overloading, the "BL" provides quiet, stable, output from free delivery to shutoff. The smoothly-curved inlet bell, with directional guide vanes and matching shroud, assures minimum turbulence. Highest efficiency is attained by the streamlined wheel with backward curved blades, factory tested and balanced to hold vibration to an absolute minimum. The correctly shaped scroll of the wheel-contoured housing further contributes to smooth air flow. For full information on the rugged, reliable "BL" Fan for Class I and II conditions, contact your "Buffalo" engineering representative. Or, write direct for Bulletin F-104.

You get a *value dividend* with the "Q" Factor — the built-in QUALITY that provides trouble-free satisfaction and long life in *every* "Buffalo" product.

"Buffalo"

BUFFALO FORGE COMPANY • Buffalo, New York

Buffalo Pumps Division, Buffalo, New York

Canadian Blower & Forge Co., Ltd., Kitchener, Ont.

VENTILATING AIR CLEANING AIR TEMPERING INDUCED DRAFT EXHAUSTING FORCED DRAFT COOLING HEATING PRESSURE BLOWING

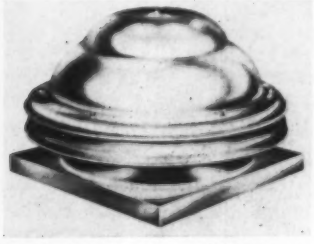
EQUIPMENT DEVELOPMENTS

Continued

Water Heaters . . .

. . . in gas fired and electric models —*H. C. Little Burner Co., Inc., Dept. HPAC, San Rafeal, Calif.*

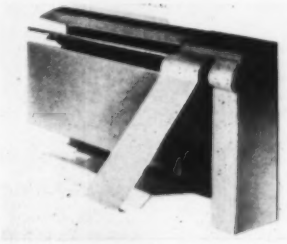
New line includes galvanized and glass lined tanks of 20 to 100 gph capacities in commercial models. Off-center flue-ways, internal baffling conducting super-heated gases to side of flue chamber said to improve heat transfer.



Power Roof Ventilators . . .

. . . designed to better conform with climatic conditions, architectural requirements—*Carnes Corp., Dept. HPAC, Verona, Wis.*

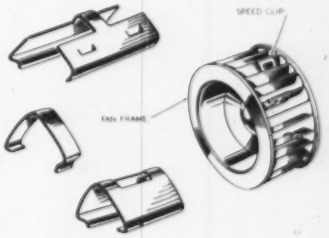
Motor covers separated from fan hoods with optimum air space permitting better motor ventilation, retaining weatherproof design, says manufacturer. Air space said to lessen chamber resonance, cause mechanical sound pattern to be nullified. Motor is out of air stream. All motors have sealed bearings.



Baseboard Accessories . . .

. . . including wall trims, end caps, valve enclosures, inside corners, designed to snap in place—*Slant-Fin Radiator Corp., Dept. HPAC, 130-15 89th Rd., Richmond Hill 18, N. Y.*

Hinged accessories allow immediate installation without waiting until plaster or sheet rock is mounted. Front portion of accessory can be lifted for access to valves or vents. Dimensions: end cap and wall trims, 4 in. wide; valve enclosures, 8 in. wide; inside corners, 3¾ in. wide.



Fan Balancing . . .

. . . developed to lessen wear, increase efficiency—*Tinnerman Products, Inc., Dept. HPAC, P. O. Box 6688, Cleveland 1.*

"Speed Clips" are spring steel fasteners, available in 3.5, 7, 14, 28 grain weights. They are snapped on by hand over fan blades where they retain themselves under live spring tension. Will not jar or vibrate loose, but can be removed and repositioned.

Your ideas work better when you work with HONEYWELL

The following pages bring you the latest developments in automatic controls from Honeywell. They widen your choice of products, give you more to work with.

For complete information on these new control products and systems, call your nearest Honeywell sales office. Honeywell provides 112 offices throughout the country; each is staffed with capable control specialists to assist you in preparing proposals and writing specifications.

Look over these new products and systems. And, remember, they are backed by the kind of support only Honeywell can offer you.

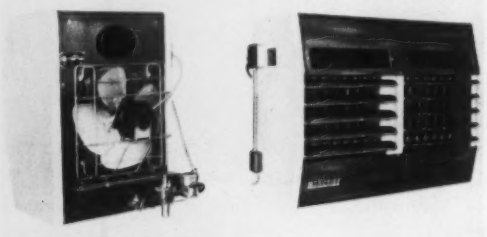
FOR MORE TO WORK WITH ... WORK WITH HONEYWELL

EQUIPMENT DEVELOPMENTS *Continued*

Tube Flaring . . .

. . . developed for use in shop or field—*Parker Fitting & Hose Div., Parker-Hannifin Corp., Dept. HPAC, 17325 Euclid Ave., Cleveland* 12.

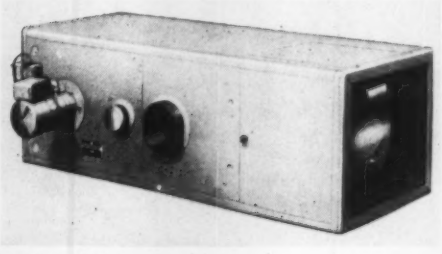
"Portaflare" may be clamped in bench vise or held in hands. Unit uses heavy duty universal gear head electric motor operating on d-c or 60 cycle a-c 115 volt power. Ball and roller bearings used throughout with permanent lubrication; frame is cast aluminum. Tool flares fully annealed steel, stainless steel hydraulic tubing, other materials in sizes ¼ through ¾ in. OD, wall thicknesses to 10 percent tube diam.



Gas Unit Heaters . . .

. . . in five new models—*Henry Furnace Co., Dept. HPAC, Medina, Ohio.*

Unit heaters intended for installation in industrial, commercial buildings to burn natural, manufactured, mixed or LP gas. Heaters have steel burner head tapered to deliver fuel mixture to entire length of stainless steel ribbon burners at same pressure. Heating capacities are 60,000, 90,000, 120,000, 180,000, 240,000 Btu per hr input.



Gas-Fired Furnaces . . .

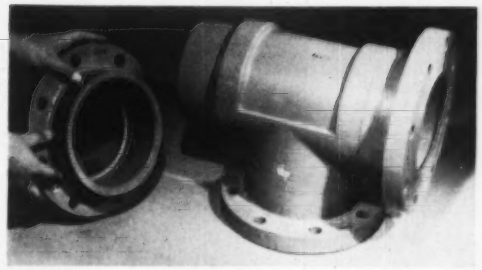
. . . designed for use in commercial, industrial buildings—*OverHead Heaters, Inc., Dept. HPAC,* 1612 *Book Bldg., Detroit* 26.

Furnaces offered in three basic models rated at 142,000, 182,000, 252,000 Btu output. Power burner intended to provide closer control of combustion gases through heat exchanger. Can be adapted in field for either right or left hand installation. All models furnished with controls, power burner and blower and with or without filters as required.

In a restaurant application, the Honeywell Activated Charcoal Filter has high absorption capacity for such objectionable odors as tobacco smoke, burning fat, fish and others likely to be present. In the past, increased outdoor air intake was necessary to diffuse these odors, which resulted in higher air conditioning costs. Now Honeywell's filter removes the odors, enables air conditioning to be operated economically with reduced air intake.

EQUIPMENT DEVELOPMENTS

Continued



PVC Pipe Fittings . . .

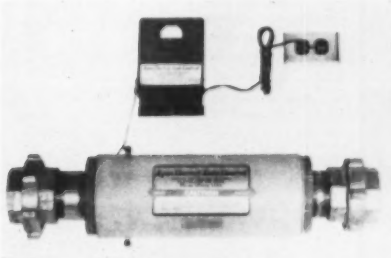
. . . for large size (6 in.) piping—*Tube Turns Plastics, Inc., Dept. HPAC, 2929 Magazine St., Louisville* 1.

Line of 6 in. fittings, flanges, previously available only in ½ to 4 in. sizes, allows use of corrosion resistant PVC piping at higher pressures. Features cited: good resistance to bending stresses; better joints with optimum flow conditions; wide range of corrosion resistance. Molded elbows furnished with sockets, male end or male end grooved to accommodate Victaulic couplings. End inserted into socket-type flange, eliminating nipple.

Water Heater . . .

. . . designed to eliminate need for booster tank—*Republic-Odin Appliance Corp., Dept. HPAC, 2231 Randolph St., Huntington Park, Calif.*

"No. 336 Hi-Recovery 8-Flue Circulator" has input of 240,000 Btu per hr and can produce water of 180 F temperature. Applications suggested by manufacturer include apartment, office, industrial and commercial buildings.



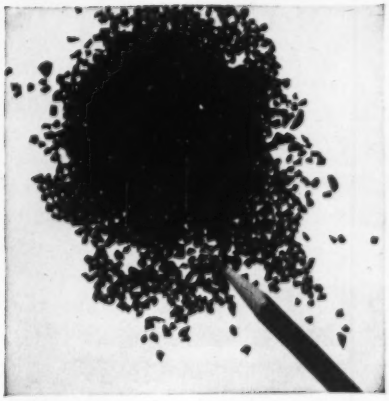
Scale Control . . .

. . . developed to treat water electrically for prevention of hard scale formation in all types of equipment—*Aqua Electric Scale Control, Inc., Dept. HPAC, 2026 E. 22nd St., Cleveland* 15.

Unit employs new circuit with electrical components designed for more positive control of power input with increase in efficiency. Unit operates on 110 volts, but said to require small current to create physical change in form in which scaling precipitates. No chemicals are necessary. Units available in five sizes: from ¾ to 4 in. and with treating capacities from 18 to 150 gpm.

For your mechanical systems . . . Honeywell Air Filters

Their activated charcoal removes odors, lowers air conditioning cost!



Only the best activated charcoal is used in Honeywell Air Filters. This charcoal, made from coconut shells, has more pores, more area for absorption. (Roughly, 125 acres per pound.) It is hard and durable, does not dust off or powder in service.

Here's a better, more economical solution to the problem of odors than either masking or diffusion. This new Honeywell Air Filter uses the principle of absorption by activated charcoal to filter return air, reduce the amount of intake air needed and produce savings in air conditioning installation and operating costs.

Combined with the Honeywell Electronic Air Cleaner, this new Air Filter provides air with the highest level of purity and cleanliness possible. Restaurants, hospitals and factories are only a few of the applications where this result is desired.

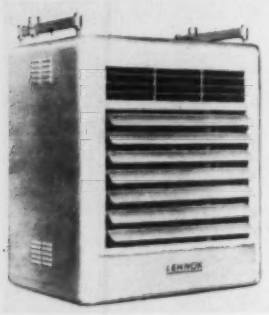
For convenience in specifying and installing, the Honeywell Air Filter is available in four different sizes and types of cells. These cells are easily removable from the frame for re-activation which Honeywell does at low cost. For further information, contact your local Honeywell office or write Minneapolis-Honeywell, Dept. AC-10-103, Minneapolis 8, Minnesota.

Honeywell

First in Control

EQUIPMENT DEVELOPMENTS

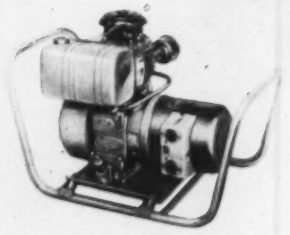
Continued



Unit Heater . . .

. . . ranging from 64,000 to 200,000 Btu per hr output capacities—*Lennox Industries Inc., Industrial Div., Dept. HPAC, 1701 E. Euclid, Des Moines.*

Fan-type heater designed for any application requiring direct, diffused warm air in less than extreme high output capacities. Construction features include: vertical, horizontal louvers to diffuse warm air over wide area. Heavy-duty heat exchangers are 18 gage aluminized steel tubes with 16 gage aluminized steel header plates. Automatic pilot with safety shutoff, automatic gas valve, 115 volt adjustable gas pressure regulator, high limit control, manual main gas and pilot valves included in unit's standard controls.



Portable Generator . . .

. . . in direct coupled, beltless design —*Thor Power Tool Co., Dept. HPAC, Prudential Plaza, Chicago* 1.

Generator "Model EG-2.5D" is mounted horizontally on protective tubular frame which serves as carrying handle. Gasoline engine is 4 cycle, single cylinder, air cooled; nominal engine speed is 3600 rpm. Generator has 2500 watt capacity, supplies 115 volts.

Pipe Insulation . . .

. . . in snap-on type design—*National Aniline Div., Allied Chemical Corp., Dept. HPAC, 47 West St., New York* 6.

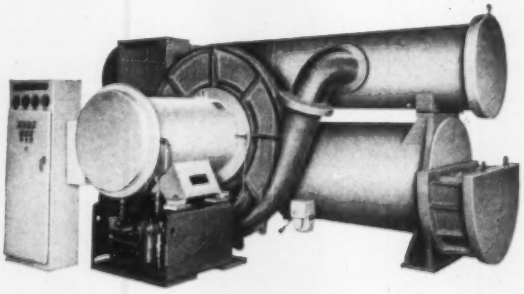
Urethane insulation designed for service between —200 F and 250 F. Recommended for refrigeration work, low-pressure (5 psig) steam lines. Has low *k* factor, good resistance to chemicals, solvents, according to manufacturer. Unaffected by high humidity, will not rot, decay, is verminproof. Produced in standard or special preformed sections or flat blankets in various sizes, thicknesses.

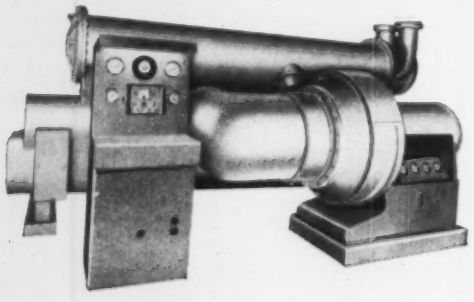
FOR MORE TO WORK WITH ... WORK WITH HONEYWELL

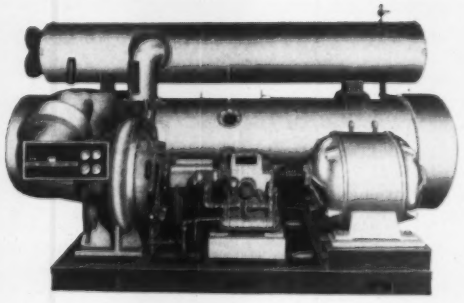
Honeywell Electronic correction of centrifugal

Leading manufacturers use Honeywell controls

Note the free selection of panel location permitted by these Honeywell electronic controls as they are used by leading manufacturers. They hold the chilled water in these machines within plus or minus 1½°—often within plus or minus ½°. The system does not require a wide throttling range, therefore there is little offset from the control point. The motor load limiting system on these controls provides instantaneous correction of vane position.







EQUIPMENT DEVELOPMENTS
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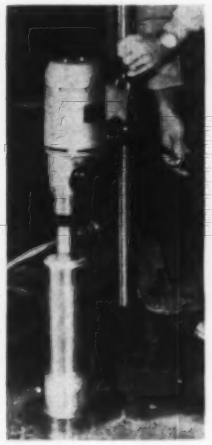
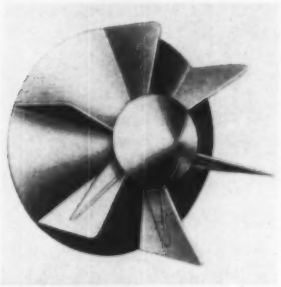


Diamond Drills . . .

. . . developed for rapid drilling through reinforced concrete, brick, stone, tile, other hard materials—*E. J. Longyear Co., Dept. HPAC, 76 S. Eighth St., Minneapolis.*

Bits of drills set with small diamonds. Setting exposes sharp edges of each stone, permitting high penetration rates in masonry. Hole of 4 in. in concrete 4 in. thick can be drilled in 4 min or less, says manufacturer. Available as electric drills with water swivels in sizes ¼, ⅜, 1¼ in. Bit sizes range ⅜ to 6½ in.



Fan Wheel . . .

. . . designed for exhausting air containing clinging type fibrous material such as wool, cotton rayon, etc.—*Chicago Blower Corp., Dept. HPAC, 9867 Pacific Ave., Franklin Park, Ill.*

Constructed with heavy back plate, fins, steel spider, "Wool Wheel" has sloping surface back of fan blades to prevent fibrous material from clinging. Fan also has cone over hub to inhibit clinging action. Available in wheel sizes 9½ to 60½ in., steel plate exhauster capable of moving 200 to 50,000 cfm of air at static pressures to 15 in. WG. Fans made in two classes for temperatures to 1000 F.

Pipe Cutter . . .

. . . with extra wide rollers to prevent spiraling—*Beaver Pipe Tools, Inc., Dept. HPAC, 310 Dana Ave., Warren, Ohio.*

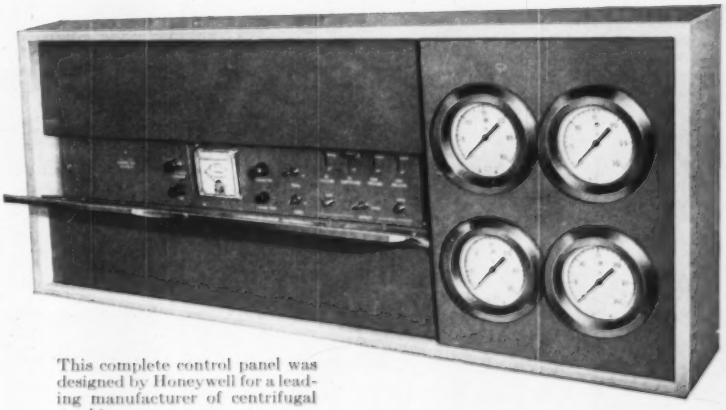
"Non-Spiral Clear Vue Cutter" cuts ⅛ to 2 in. material by hand or with power drive. Position of wheel gives view permitting quick, accurate setting to mark, says manufacturer.

Controls give accurate sensing, rapid refrigerating machines

This Honeywell Electronic Control System combines the functions of chilled water temperature control and motor load control. Its application to centrifugal refrigeration offers your clients these important advantages:

- Rapid, accurate control of chilled water temperature; instant, positive correction.
- Maximum input current can be set at any predetermined value by a simple adjustment of the load limiting switch.
- The simplest, most trouble-free control of temperature and motor current.
- Consolidates all equipment in one location, permits setup, adjustment and service from the central panel, keeps adjustments secure in a tamper-proof enclosure.
- Permits free selection of panel location—troublesome capillaries are eliminated.

For further information call your nearest Honeywell office. Or write Minneapolis-Honeywell, Department AC-10-103, Minneapolis 8, Minnesota.



This complete control panel was designed by Honeywell for a leading manufacturer of centrifugal machines.

Honeywell

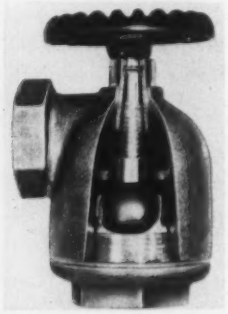
First in Control

EQUIPMENT DEVELOPMENTS
Continued

Atomizing Nozzle . . .

. . . designed for simultaneous spraying in two or more directions—*Spraying Systems Co., Dept. HPAC, 3219 Randolph St., Bellwood, Ill.*

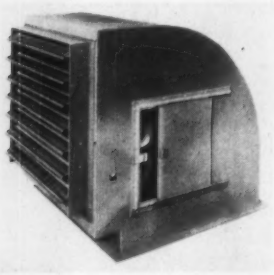
Nozzle can be supplied with two, three, four heads, adjustable to any position in 360 deg range. Overall nozzle unit measures 1¼ × 2 in. at maximum cross section; 4-13/32 in. in height; additional swivel heads add 1-3/32 in. each to height. Nozzles supplied standard in brass, also available in stainless steel.



Shutoff Valve . . .

. . . developed to insure positive closure despite heavy use—*Rene Mfg. Co., Dept. HPAC, 804 Northwestern Bank Bldg., Minneapolis 2.*

Valve has neoprene ball which, when stem is retracted, is forced against beveled seat by fluid inlet pressure to form positive seal against leakage. When valve is open, ball floats free but remains axially aligned with seat; reverse stem threads permit conventional operation of valve. Stem leakage said to be eliminated by o-ring seal. Cast of bronze, with machined brass stem, valve is available in angle or in-line models for working pressure to 150 psi. Available in sizes ¾ and 1 in.



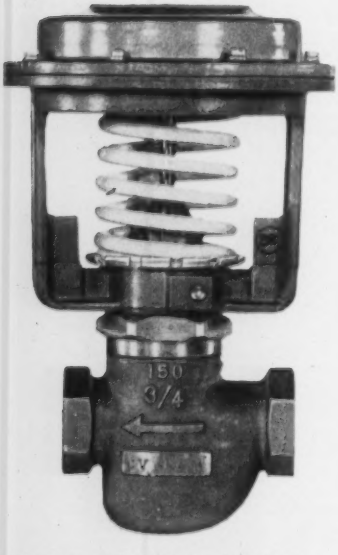
Penthouse Ventilators . . .

. . . designed for quiet operation—*Power Line Fan Co., Dept. HPAC, 639 South Ave., Plainfield, N. J.*

Types "DRP" and "BRP" intended for use ventilating systems where large volumes of air are to be moved at low static pressures. Quiet performance due to streamlining and further undercoating with sound-deadening material. Special in-

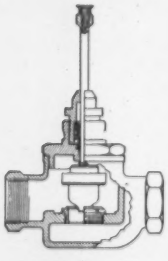
For your mechanical systems . . .
New Honeywell Pneumatic Valve and Motor

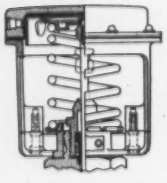
FOR MORE TO WORK WITH ... WORK WITH HONEYWELL



Single seated or three-way valves available in a complete range of sizes. For more information, call your local Honeywell office.

New materials . . . new designs increase performance for control of steam or water





Valve features! Equal percentage throttling plug plus longer stroke gives better control of steam or water flow at light load.

Exclusive Teflon cone packing lowers friction, lasts longer, requires less lubrication. Easier to change because it comes out with packing nut.

Spring loaded stem and disc holder connection eliminates noise and wear, lasts longer.

Plug type throttling guide eliminates "pocking" of discs due to impingement of fluid through old V Port types.

Packing nut design eliminates periodic tightening, impossible to over- or under-tighten.

Actuator features! Diaphragm design gives more power for smaller diameter. Saves space, positions valve better, gives high close-off ratings. Larger diameter spring eliminates buckling, doesn't rub stem.

Tough Neoprene diaphragm gives longer wear, in normal temperature use. (Silicon available for extremely high temperatures.)

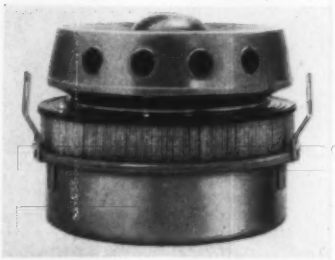
Quick stem-release slide makes actuator easy to remove from valve to change size or to service.

Normally open and normally closed actuators easily interchangeable. Sizes interchangeable, too.

All parts—corrosion resistant.

EQUIPMENT DEVELOPMENTS
Continued

sulation available to meet extreme climatic conditions. Unit has large front overhang with built-in water bypass tray to collect, channel excess rainwater back to roof excess rainwater.



Humidifier . . .

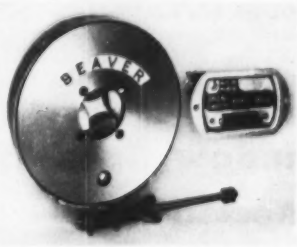
. . . with centrifugal atomizer designed to produce fine water vapor without heat—*Walton Laboratories, Inc., Dept. HPAC, 1136 Grove St., Irvington 11, N. J.*

Humidifier has accordion filter with 620 surface areas. Units evaporate 1 gph. Installation requires only water and electrical connections.

Compressor Protection . . .

. . . designed to provide more positive protection against excessive winding temperatures within hermetically sealed motors—*General Electric Co., Air Conditioning Div., Dept. HPAC, 570 Lexington Ave., Room 302, New York 22.*

Protective system employs thermostat buried in end-turns of motor windings. When predetermined temperature is reached, unit automatically turns off. Thermostat feels winding temperatures directly.



Pipe Chuck . . .

. . . designed to eliminate manual chucking—*Beaver Pipe Tools, Inc., Dept. HPAC, 310 Dana Ave., Warren, Ohio.*

Jaws of "Electrimatic Chuck" grip pipe or rods automatically with flip of switch. Range: 1/8 to 2 in. Operates either forward or reverse. All wearing parts of hardened tool steel.

Water Heater . . .

. . . recommended for commercial, industrial uses—*Radiant Utilities Corp., Dept. HPAC, 8317 18th Ave., Brooklyn.*

"PK" series are completely pack-

For your mechanical systems

Now, a Honeywell Pneumatic Round Thermostat for every installation, every function!

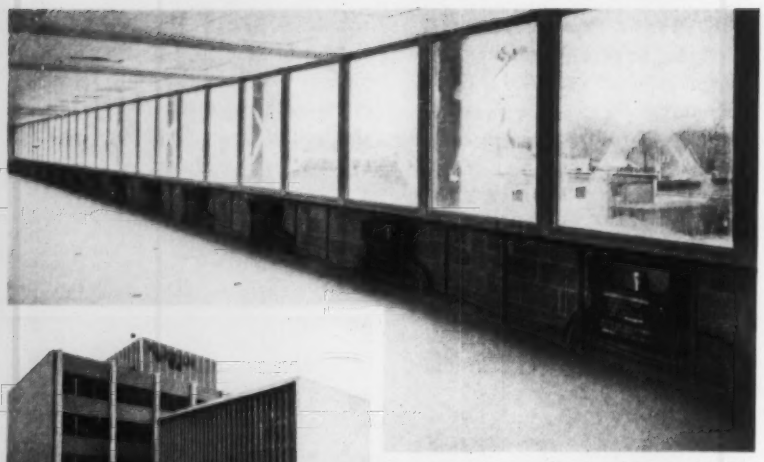
Now Honeywell offers models of the famous Pneumatic Round Thermostat for every application—summer-winter, day-night, modulating, two-position, and submaster.

All versions provide the accuracy, fast-response and dependability of the Honeywell Pneumatic Round, the only new pneumatic thermostat in the industry. And all models feature the world's most popular round thermostat styling.

Simplified design and a complete line of installation fittings make these thermostats easy to install and maintain. Pleasingly styled, tamper-proof guards are available where needed.

Honeywell

H First in Control



Two connections were easily made to each of 99 underwindow units, even though no two hookups were alike—Colorado Hospital Service and Colorado Medical Service, Inc., Bldg., Denver.

198 different underwindow hookups . . . all easily connected with WIREMOLD FLEXIBLE AIR DUCT

Construction—The exclusive Wiremold construction locks fabric to metal securely. This positive mechanical lock guarantees long life—no adhesives are used.

Problem: This dual-duct system was to be fed through the floor to 99 underwindow units. Since no two connections would be exactly alike, a versatile method for hooking them up was needed. In addition, mechanical vibrations had to be dampened before the air was distributed into the room.

Solution: Wiremold Air Duct. Its flexibility made it easy to make the connection between branch ducts and the units, even where tight bends were required. Its construction also effectively checked vibration.

Light and rugged, Wiremold Flexible Air Duct is so easy to cut, fit, and install that contractors have been thinking of new ways to use it that even we hadn't thought of. Furthermore, under identical conditions, the friction loss of Wiremold is only slightly more than for rigid duct work — normally not enough to require any increase in fan capacity.

FIVE COMMON USES

1. To connect perimeter underwindow units with vertical risers.
2. To connect branch duct to single ceiling outlet.
3. From attenuation box to outlets in modular ceiling.
4. Between branch duct and attenuation box, on the high pressure side.
5. Vertical take-off from branch runout to ceiling pan-type outlet in low and medium pressure systems.

SEE US AT BOOTH 448, INTERNATIONAL HEATING AND AIR CONDITIONING EXPOSITION, PHILADELPHIA, JAN. 26-29.

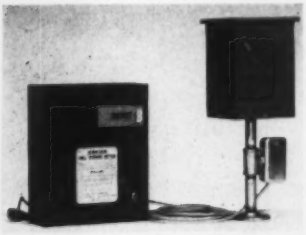
WIREMOLD® FLEXIBLE AIR DUCT

For full information, write The Wiremold Company, Hartford 10, Conn.

EQUIPMENT DEVELOPMENTS

Continued

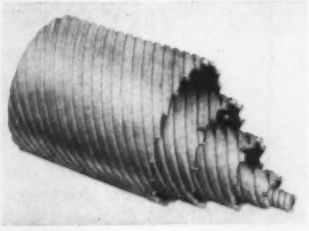
aged, automatic, glass lined direct oil fired water heaters available in three models: 135, 200, 270 gph. Features cited include: high temperature combustion chamber; fully insulated tank packed with rock wool fiber.



Fuel Demand Meter . . .

. . . designed to register total accumulated effective degree days—*Johnson Degree Day Systems, Dept. HPAC, 329 S. Pitcher St., Kalamazoo, Mich.*

Effective degree days (net effect of temperature, sun, wind upon fuel consumption) measured by weather-sensitive element fastened to roof, exposed to weather by electrical cable to inside unit located on wall or desk. Operates on 110 volts. Standard instrument gages range from 65 F base to −35 F. Meter has reset mechanism so total can be set to any accumulated reading.



Masonry Drills . . .

. . . developed to permit drilling of concrete with or without reinforcing rods—*New England Carbide Tool Co., Dept. HPAC, 55 Commercial St., Medford 55, Mass.*

"Cyclo-Core" carbide-tipped rotary masonry bits available in diameters 1½ to 6 in. Features cited: precision-ground cutting edges; multi-spiral tip-to-shank flutes; removable shanks; brazed carbide tips; can be resharpened.

MEMO TO MEN
ON THE WAY UP

WHERE THERE'S BUSINESS ACTION THERE'S A BUSINESSPAPER

Used to be a song, back in the Thirties, titled, *Little Man, You've Had a Busy Day.* Didn't mention the Big Man. But his days are busy, too. He's the man who must make top-level decisions in business. And to make those decisions, he must have facts. All the facts. All the pertinent information he can get.

He finds time, in his busy days, to get that information. How? By getting a major portion of it from one unique source: the business publications serving his particular field.

No businessman, Little or Big, is fully informed until he reads his businesspaper. He reads it for profit, not for pleasure. He searches it through for news of the trade or industry. For facts. For fresh ideas. For new products he can put to work. And he reads the advertising with the same intense concentration he devotes to the editorial pages.

For the man on his way toward becoming a Big Man, his businesspaper is especially important. Take a tip from the reading habits of key men at every level. Take out a subscription of your own. Then, make the time to read every issue—and read it thoroughly.

Heating, Piping & Air Conditioning

One of a series of advertisements prepared by THE ASSOCIATED BUSINESS PUBLICATIONS

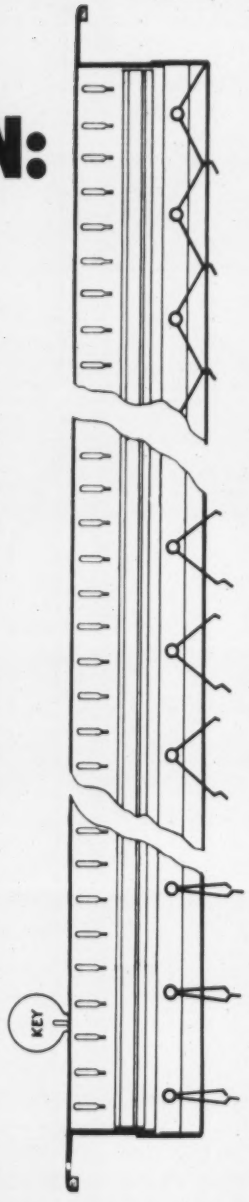
PROBLEM:

3 1/4"

To find a commercial-type register with four way air-direction control plus volume control, that will work in standard 3¼" duct.

SOLUTION:

2 7/16"



AIR CONTROL'S *Multi-Trol* Registers have exclusive **Shallo-Valve** – fit fine in 3¼" duct, leaving plenty of space for full air volume. And note how this patented butterfly valve action provides positive air volume control – assures even air distribution over register face at any setting. Seals *tight* when closed – can't whistle or rattle.

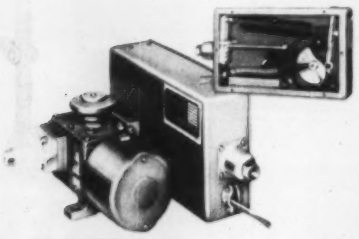
Ideal for both heating and cooling in commercial and deluxe residential installations, Air Control's *Multi-Trol* registers feature fully adjustable face bars for 2-way or 4-way control of air pattern. Bars have air foil shape and are locked to side margins – can't come loose. Complete range of style and sizes. Attractive beige prime coat.

FREE '58 CATALOG SHOWING COMPLETE AIR CONTROL LINE — SEE YOUR JOBBER OR WRITE US.

AIR CONTROL PRODUCTS, Inc.
358 Center St., Coopersville, Michigan

EQUIPMENT DEVELOPMENTS

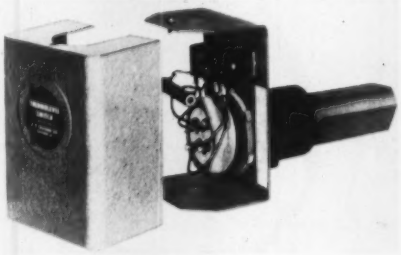
Continued



Drive Regulator . . .

. . . with special drive motor that can be stalled indefinitely, continuously reversed—*Optimum Control Corp., Dept. HPAC,* 2930 *Woodhill Rd., Cleveland* 4.

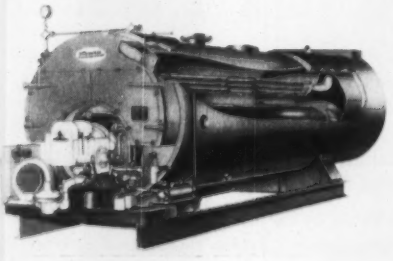
Designed to control pressure or temperature, "Master Regulator" is electrically operated with wide proportional band adjustment range. Unit shown has torque range to 204 in.-lb pressure range to 600 in.-lb; others available up to 12,000 in.-lb torque.



Liquid Level Switch . . .

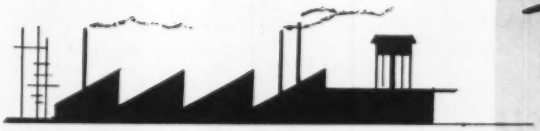
. . . designed to provide switching action on rise or fall in liquid level—*J. E. Watkins Co., Dept. HPAC,* 307 *Lake St., Maywood, Ill.*

No valves or equalizer lines required with "Thermo-level" switch. Unit has no moving parts, is hermetically sealed against moisture. Fits into 1½ in. coupling, projecting into vessel or header at lever to be controlled. Available in six models in standard temperature ranges —60 to 70 F. with other temperature ranges available. Switching circuit capacity: 10 amps at 115 volts, 5 amp at 230 volts. Explosionproof models also available.



Scotch Marine Boiler . . .

. . . in three-pass design with watercooled rear combustion chamber—*Titusville Iron Works Div., Struthers*



Duct Costs go down

ON INDUSTRIAL JOBS...

install SONOCO SONOAIRDUCT® FIBRE DUCT

for warm air gas and oil fired slab perimeter heating systems!

Large diameter SONOCO Sonoairduct Fibre Duct increases your profits by cutting installation time. Sonoairduct is lightweight, easy to handle and levels quickly. Available in lengths up to 50' long, and can be sawed to exact lengths on the job. Ideal for industrial heating and ventilating, schools, shopping centers, etc.

23 sizes—2" to 36" I.D. Aluminum foil lined. Approved by contractors everywhere. Meets and exceeds F.H.A. criteria and test requirements for products in this category. Free installation manual available. See our catalog in Sweet's.

For complete information and prices, write

- HARTSVILLE, S. C.
- LA PUENTE, CALIF.
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1347

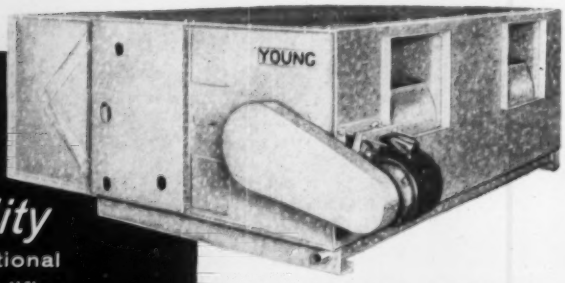
SONOCO

Construction Products

SONOCO PRODUCTS COMPANY

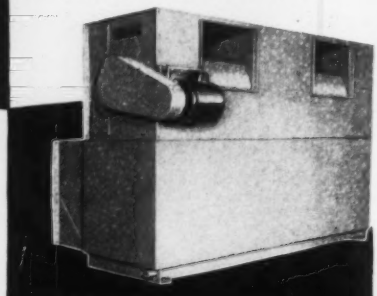
NEW "sectional-designed" UNITS

BY Young makes central station air conditioning easy!

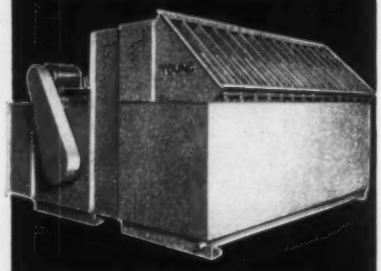


flexibility of new sectional design simplifies selection . . . makes it easier to choose a tailor-made unit for any application

HORIZONTAL UNITS
Available in ten sizes with capacities from 700 cfm to 28,000 cfm.



VERTICAL UNITS
Available in ten sizes with capacities from 700 cfm to 28,000 cfm.



MULTI-ZONE UNITS
Available in nine sizes, and with a selection of 2 to 21 zones.

Complete interchangeability of all sections makes it possible to choose any type of installation from a simple ventilating unit to a complete air conditioning system that will meet the most exacting requirements.

Three Basic Models...Wide Range of Sizes Available

Both Horizontal and Vertical types are available in 10 sizes. Multi-zone units are offered in 9 sizes with from 2 to 21 zones. Air volume capacities range from 700 cfm to 28,000 cfm. This wide range of capacities and unusual flexibility makes them ideal for air conditioning practically any size building.

Easy to Install and Service

Access panels and doors permit ready inspection and service. Bolting holes between all sections are common making all sections interchangeable. They can be easily handled through doorways and narrow passages without using cranes and hoists.

write for FREE catalog...

Write to Dept. 518-K for Catalog No. 7558

Young RADIATOR COMPANY
RACINE, WISCONSIN
Creative HEAT TRANSFER ENGINEERS
Executive Offices: Racine, Wisconsin, Plants at Racine, Wisconsin, Mattoon, Illinois

EQUIPMENT DEVELOPMENTS

Continued

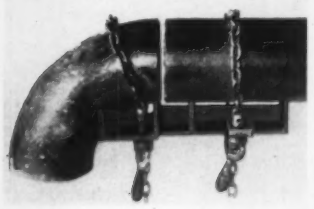
Wells Corp., Dept. HPAC, Titusville, Penn.

Boiler has complete "wet back" construction to keep hot gases in constant contact with water cooled steel walls, utilizing useful heat of gases. Unit manufactured in low pressure "S3H" series and high pressure "S3P" series in sizes 1725 lb of steam per hr to 31,050 lb of steam per hr. Boiler efficiency of three-pass units exceeds 80 percent with light or heavy fuel oil and gas or combination oil and gas fired.

Mass Flowmeters . . .

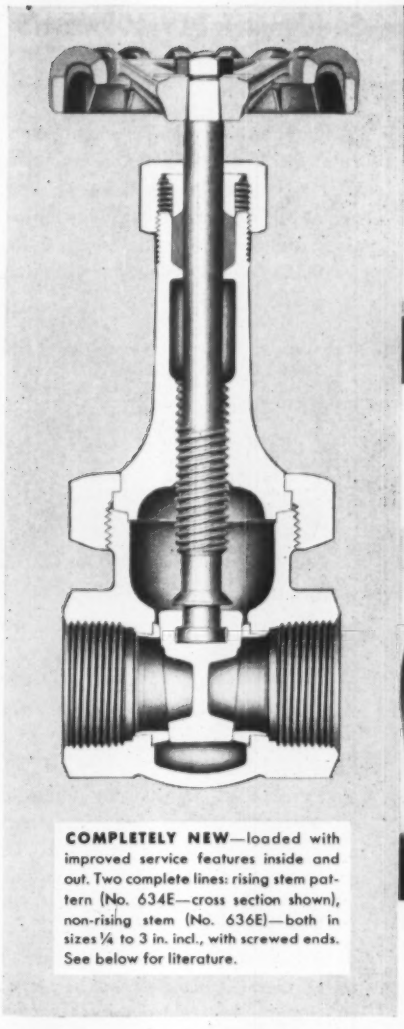
. . . developed to provide direct reading of total mass flow, independent of temperature, pressure variations—*Hastings-Raydist, Inc., Dept. HPAC, Hampton, Va.*

Instruments calibrated directly in milligrams of air per min. Measurement of mass flow accomplished by incorporating heated thermopile element in flow tube. Thermopile is self-compensating for both ambient temperature and rate of change of temperature. Flow tube can be installed directly in flow line or can be placed in bypass to measure fraction of total flow. "Model MF-1" has range zero to 10,000 mg air per min. "Model SM-1" has lower range from zero to 500 mg of air per min.

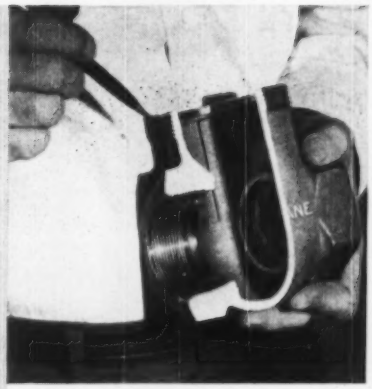


Pipe Clamp . . .

. . . for aligning, holding pipe during tacking—*Jewel Mfg. Co., Dept. HPAC, 1841 University Ave., St.*

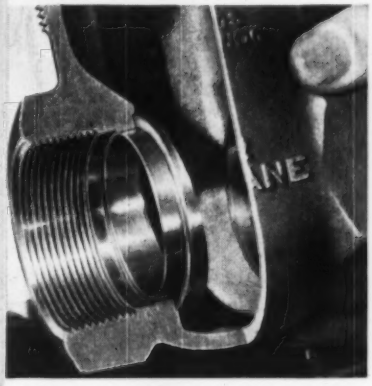


COMPLETELY NEW—loaded with improved service features inside and out. Two complete lines: rising stem pattern (No. 634E—cross section shown), non-rising stem (No. 636E)—both in sizes ¼ to 3 in. incl., with screwed ends. See below for literature.



NEW CYLINDRICAL BODY SHAPE—a proven design on high-pressure steel valves—increases strength without added bulk, distributes pressure load uniformly, resists distortion and leakage at seats.

NEW, STRONGER HEX ENDS, better integrated with body, eliminate sharp contours, give entire valve more rigidity under line strains. Wider hex faces allow firmer wrench grip for easier installation. Marring less likely.



NEW, EXPANDED-TYPE BODY RINGS insure long, tight-seating service life. They're rolled in, can't work loose. Shoulder at bottom of end threads restrains excessive entry of pipe against possible seat damage.

NEW EXELLOY, 12% chromium steel body rings give a hard bearing surface, highly resistant to wear, indentation, scoring and foreign matter damage. Easily replaced bronze disc takes the brunt of normal wear.

New design for tough service...easy maintenance

300-Pound Wedge Disc Bronze Gate Valves

Rising Stem and Non-Rising Stem Patterns

A new body shape that distributes greater strength uniformly against internal stresses and external strains . . . better integrated hex ends, huskier and wider, that add to body rigidity and give a firmer wrench grip . . . new rolled-in, high wear-resisting alloy body rings that don't work loose . . . easily renewed wedge disc—these are typical important features of new Crane bronze gate valves.

On your toughest services, these valves assure ultimate durability . . . new ease of application . . . low-cost repairability. And they're priced no higher than ordinary 300-pound integral seat bronze valves.

Easy to Repair—The Disc Takes the Wear

After long, hard service the hard Exelloy (12% chromium) body rings show no appreciable wear. Normal seating wear is taken by the bronze disc. When needed, a new disc, easily slipped onto stem, provides a practically new, tight-seating valve.

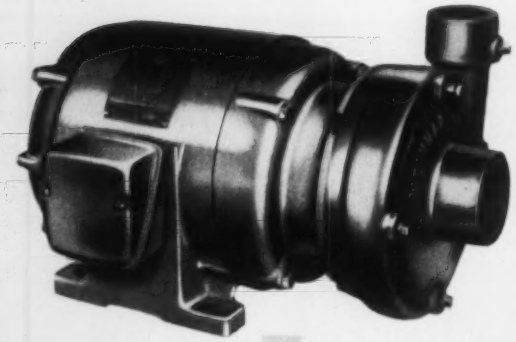
Circular Gives The Facts

For complete technical data on both rising stem and non-rising stem patterns . . . size listing, etc., get Circular AD-2340 from your Crane Representative, or by writing to address below.

CRANE VALVES & FITTINGS

PIPE • PLUMBING • HEATING • AIR CONDITIONING • KITCHENS

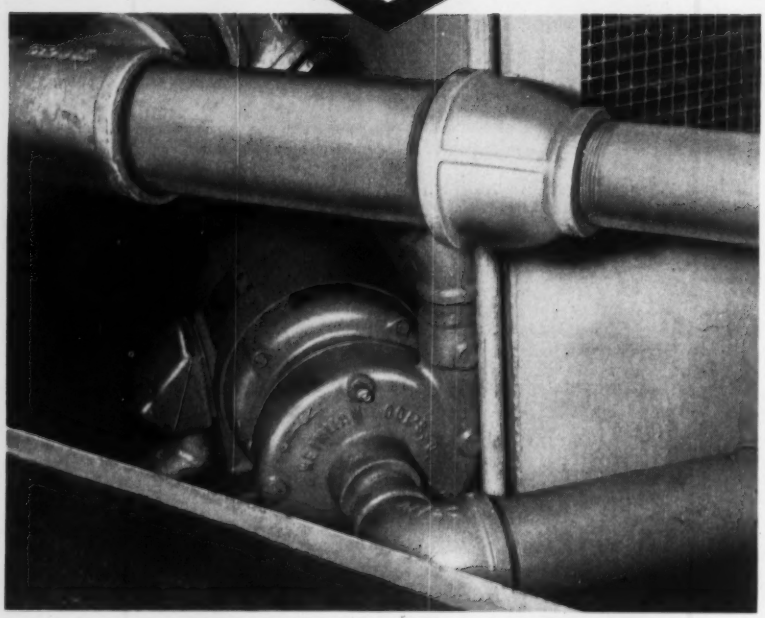
Since 1855—Crane Co., General Offices: Chicago 5, Ill. Branches and Wholesalers Serving All Areas



Compact WEINMAN AC Pumps lick tough air conditioning installation problems!

Adequate space is always a problem when you're installing air conditioning systems. That's why compact, versatile Weinman Type AC pumps are preferred by contractors and equipment manufacturers. These rugged, dependable units take little space yet pump up to 260 gpm, with heads up to 150'. And you can mount Weinman AC pumps anywhere. They operate equally well when installed vertically or horizontally. A highly polished ceramic floating seal seat and carbon compound sealing washer guarantee long life and leakless operation ... even when handling water containing abrasive particles.

Over 60 models, with ¼ to 7½ hp ratings, mean you are assured of the most efficient pump for your requirements. Bulletins No. 100 and No. 110 give full details and performance curves. Write for your free copies today.



Consult your Weinman pump specialist. He is listed in the Yellow Pages of your telephone directory.

THE WEINMAN PUMP MFG. CO.
290 SPRUCE ST. COLUMBUS 8, OHIO

Centrifugal Specialists

EQUIPMENT DEVELOPMENTS

Continued

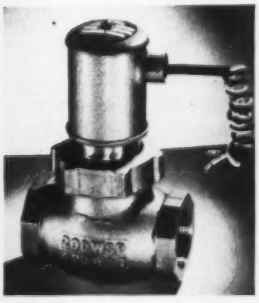
Paul 4, Minn.

New aluminum pipe clamp permits quick assembly and removal after pipe joint is tacked for welding operation. Clamps for standard pipe sizes from 2½ to 8 in., weigh 7 lb. Available for long, short turn elbows.

Surface Thermometer . . .

. . . developed to provide positive, reproducible temperature measurements on metal surfaces—*Royco Instruments, Inc., Dept. HPAC, 874 Fabian Way, Palo Alto, Calif.*

"Pyroprobe" incorporates material of surface to be measured into thermocouple circuit of instrument. To achieve maximum ± 4 percent accuracy, necessary to calibrate for specific metal on which instrument is to be used. Can also give universal metal measurements through use of conversion chart. Available in ranges zero to 450, 650 and 1000 F, unit said to give stable readings within one second. Requires no batteries.



Solenoid Valves . . .

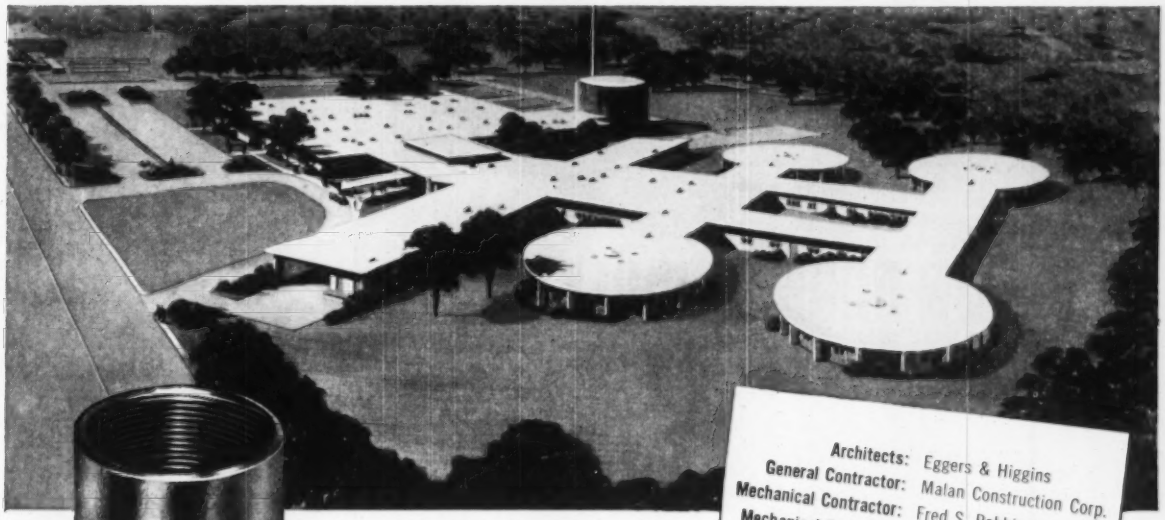
. . .designed for improved performance—*J. D. Gould Co., Dept. HPAC, 4707 Massachusetts Ave., Indianapolis 18.*

"Type Q" (normally closed) and "Type QR" (normally open) are

Wheatland Steel Pipe installed

in the nation's first

ATOMIC ENERGY COMMISSION MEDICAL RESEARCH CENTER



Architects: Eggers & Higgins
General Contractor: Malan Construction Corp.
Mechanical Contractor: Fred S. Robbins
Mechanical Engineers: Syska & Hennessy, Inc.
Pipe Distributor: Gelles-Berger Co., Inc.

Just recently completed, this modern medical center forms part of the Brookhaven National Laboratory at Upton, Long Island. It covers 2.7 acres of an 11-acre site, and houses research laboratories for medical physics, pathology, microbiology, biochemistry and physiology. The graceful, one-story structure also contains a 48-bed research hospital, an industrial medicine branch for Brookhaven personnel and a nuclear reactor designed specifically for medical research and therapy.

Here stands an architectural gem built for peak efficiency in every phase of operation. Here, as in project after project across the nation, Wheatland Steel Pipe was installed for its outstanding quality, dependable service and long life. Why not specify Wheatland Steel Pipe for *your* installations?

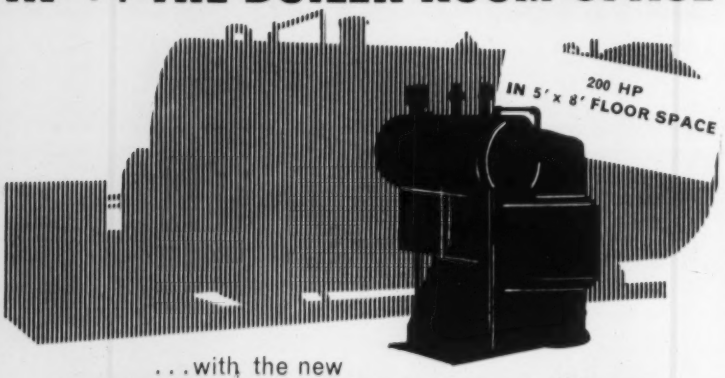
...pipe with the yearmark!

For information about Black or Galvanized Steel Pipe, contact

WHEATLAND TUBE CO.

BANKERS SECURITIES BUILDING, PHILA. 7, PA. • MILLS: WHEATLAND, PA. • DELAIR, N. J.

GET THE SAME STEAM OUTPUT IN ¼ THE BOILER ROOM SPACE

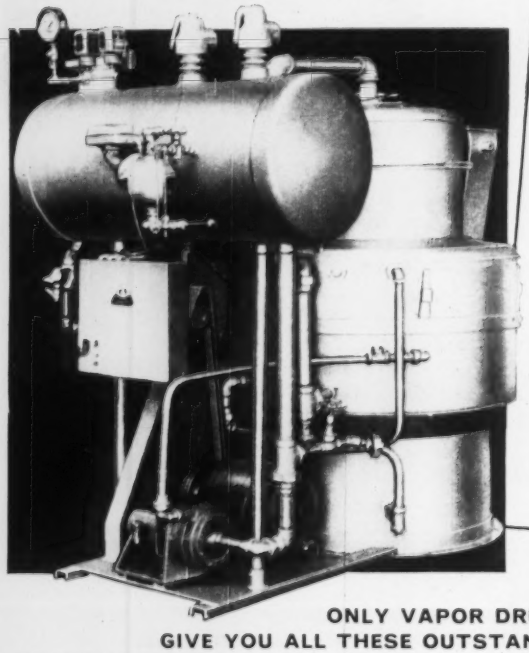


...with the new

VAPOR DRUM MODULĀTIC

WATER-TUBE BOILER

"World's Most Compact Heat and Power Package"



Provides steam in 5 minutes from cold start. 0-15 psi for heating, 5-150 psi (or higher) for process, power, countless production applications

Instant unlimited hot water, high or low temperature

Wide range of models, 20 to 200 hp., 670,000 to 6,690,000 btu/hr.

"MONEY-MAKER SERIES"

ONLY VAPOR DRUM MODULĀTICS GIVE YOU ALL THESE OUTSTANDING FEATURES

Low Installation Cost. DRUM MODULATICS are delivered as complete units, fully assembled, wired and tested, ready for operation. No wall removal . . . units fit through shop doors. No expensive chimney . . . MODULĀTICS have built-in forced draft.

Explosion Proof Safety Features. Built-in, automatic safeguards against water or flame failure, or excessive pressure.

Greatest Operating and Maintenance Economy. Fully automatic, "push-button" operation. Full steam output in 5 minutes from cold start ends early-morning reparting and standby. Hot gases wipe *all* outside tube surfaces and forced circulation of water wipes all inside surfaces to give greatest heat transfer efficiency. Simple, positive control system supplies steam as required—follows fluctuating demand. Burns oil, gas, or both.

Ideal for Multiple-Unit Installation. Great flexibility for widely-varying steam or hot water requirements. Power source is not confined to one boiler. Coordinating control system turns individual units on or off automatically as steam demand varies.

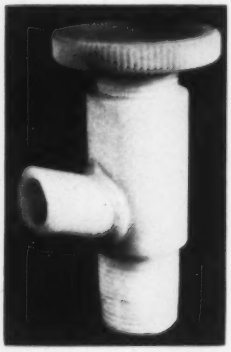
Never Require Replacement. DRUM MODULĀTIC design permits easy, simple replacement of water-tube coils (or other parts) for lifetime peak efficiency.

Write for Bulletin 475 **VAPOR HEATING CORPORATION**
80 East Jackson Boulevard, Chicago 4, Illinois, Dept. 21-J

EQUIPMENT DEVELOPMENTS

Continued

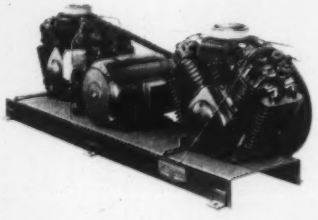
fully automatic, two-way, packless, bronze bodies, piston-pilot operated. Available in sizes ⅜ to 3 in. Intended for use with heavier liquids, air, gases to 400 psi (steam to 200 psi), temperatures to 450 F. Standard features cited: heavy duty coil assembly for handling heavier fluids; guaranteed for one year; guided pilot valve seat.



Polyethylene Valve . . .

. . . designed for use in polyethylene tanks, other vessels—*American Agile Corp., Dept. HPAC, P.O. Box 168, Bedford, Ohio.*

New ¾ in. faucet developed for draining corrosive liquids from containers. Faucet made of polyethylene and polyprolene.



Air Compressors . . .

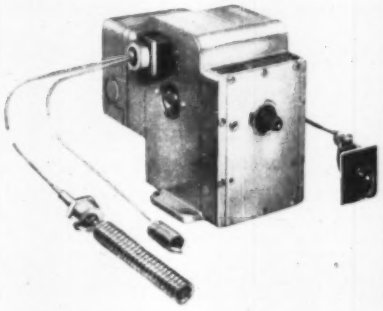
. . . designed for operation of air tools in shop, small industrial applications—*DeVilbiss Co., Dept. HPAC, 300 Phillips Ave., Toledo, Ohio.*

Double compressor units are in sizes 20, 25 hp; 125, 175 lb and will displace 96.4 to 129 cfm of air. Equipped with pressure switch, magnetically controlled unloaders. V-type cylinder compressors have bore in first stage of 4½ in., 2½ in. in second stage. Stroke is 4 in.

THE MARK OF QUALITY

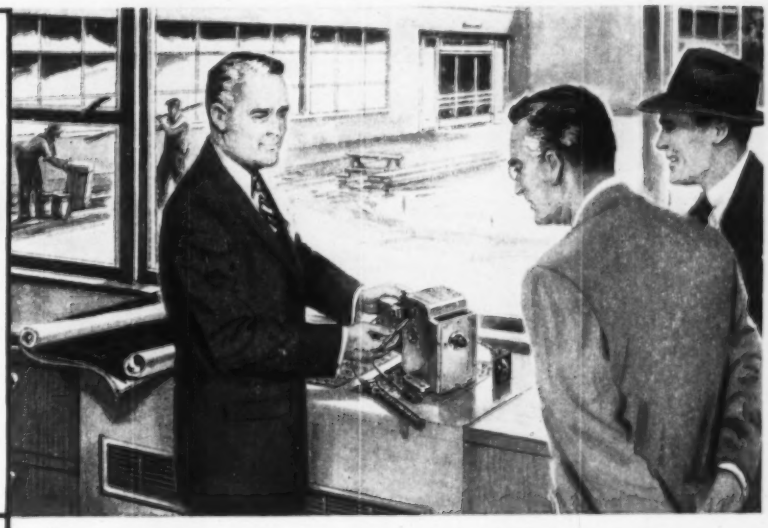
BARBER COLMAN

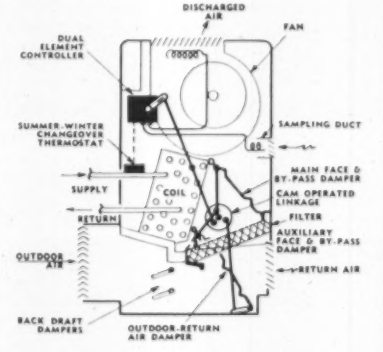
Now...improved controls for all types of unit ventilators



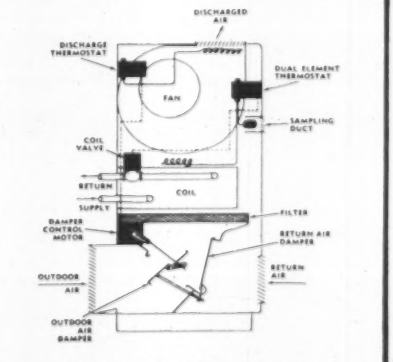
NEW! Dual-element thermostat *combined* with motor operator for face and bypass units.

NEW! Plug-in change-over thermostat for year-around face and bypass units.





FACE AND BYPASS CHAMBER CONTROLLED UNIT



VALVE CONTROLLED UNIT

Combined thermostat-and-motor operator mounts directly on unit for greater control accuracy and lower installation cost.

New all-electric Barber-Colman unit ventilator controls combine the function of thermostat and damper operator in a single "package." This eliminates the need for a wall thermostat and reduces on-the-job installation cost. (Factory installation is also practical.) Chalk dust or dirt problems and "temperature-tampering" by unauthorized personnel are eliminated.

Superior control is achieved by the dual-element principle. Sensing bulbs are used in both a room air sampling chamber and in the discharge air stream. This is the proved aspirating principle employed in the most exacting laboratory control installations.

Barber-Colman offers you the most advanced controls for *every* unit ventilator installation — steam, hot water, hot and chilled water, gas, and electric.

Ask for New Application File

— specifications and complete details on control hookups for all leading makes and models of unit ventilators. Call your local Barber-Colman representative or write today.

BARBER-COLMAN COMPANY

Dept. J, 1301 Rock Street, Rockford, Illinois • Field Offices in Principle Cities

Automatic Controls • Small Motors • Industrial Instruments • Aircraft Controls
Electrical Components • Air Distribution Products • Overdoors and Operators
Molded Products • Metal Cutting Tools • Machine Tools • Textile Machinery

NEW IDEAS? I SURE GET PLENTY AT THE POWER SHOW. NO DOUBT ABOUT IT, BILL, I ALWAYS GET A WEALTH OF ENGINEERING INFORMATION BY TALKING TO THE EXHIBITORS' TECHNICAL PERSONNEL. AND THIS IS THE PLACE TO SEE AND COMPARE NEW, COST-SAVING EQUIPMENT.
YES, ED. WE'RE ESPECIALLY CONCERNED RIGHT NOW WITH LOWERING OUR PRODUCTION COSTS, AND SOME OF THE IDEAS I'VE PICKED UP HERE ARE GOING TO HELP DO IT.

YOU, TOO, CAN SECURE VALUABLE NEW IDEAS

at the

23rd National Exposition of POWER & MECHANICAL ENGINEERING

Auspices of ASME

New York Coliseum • Dec. 1-5, 1958

See first-hand the new, cost-saving products of some 300 leading manufacturers—talk to their technical representatives and get the answers to your problems. Be informed on the newest developments, methods and products.

Save time, avoid standing in line, by filling out the coupon below and registering now, by mail!

ASME ANNUAL MEETING

with some 110 technical sessions will be held at the Statler-Hilton and Sheraton-McAlpin Hotels during the same week.

23rd National Exposition of Power & Mechanical Engineering
480 Lexington Avenue, New York 17, N. Y.

Yes, please, send me admission badge at no charge.

Name_____

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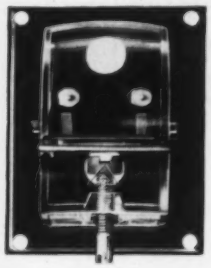
1245

EQUIPMENT DEVELOPMENTS

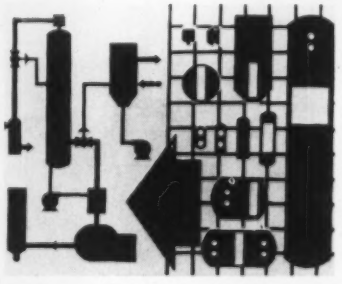
Continued



Air Filter Service Switch

. . .for operating warning light to indicate need for air filter replacement—*Bacharach Industrial Instrument Co., Dept. HPAC, 200 N. Braddock Ave., Pittsburgh 8.*

"Model MNE" switch senses proper time to change air filters, closes electrical circuit which causes filter warning light to glow. Switch suitable for either single pressure connection (between filter and blower), or differential pressure connections (across the filter), using ½ in. ID hose. Rated at 0.25 amp at 26 volts, a-c or d-c.



Instrument Designation . . .

. . .developed to reduce design time, facilitate procurement, simplify assembly of centralized graphic control centers, graphic panelboards—*Devco Engineering Inc., Pier Lane West, Dept. HPAC, Caldwell Township, Caldwell, N. J.*

Completely standardized system of graphic symbols, cutouts, interconnecting flowlines maintained in stock; finished parts can be made available by selecting appropriate key dimensions. Metals, plastics available in 16 colors. Method of attachment positive, says company.

The A.B.C. Symbol . . .

The right to purchase or refrain from purchasing this publication gives you, the reader, and no one else the power to pass judgment on whether it shall continue to survive.

This symbol represents the standards by which your voluntary response is measured.

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This symbol represents our membership in the Audit Bureau of Circulations, your assurance that our circulation facts are verified by independent audit, measured by recognized standards, and reported in standardized reports. These audited facts, available without obligation to interested persons, provide a factual basis for advertising rates, evidence of subscriber interest, facts on market coverage, and facts for appraising our circulation quality and editorial vitality.

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EQUIPMENT DEVELOPMENTS

Continued

Electronic Recorder . . .

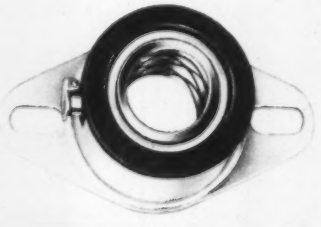
. . . with cam in electronic receiver units to correct for non-linearity of input signals—*Hays Corp., Dept. HPAC, 800 E. Eighth, Michigan City* 14, *Ind.*

With cam feature, maximum of four records can be charted on single circular chart of "Universal Electronic Recorder." Inputs such as flow, gas analysis, pH, pressure, etc. can be handled on equally divided chart.

Pipe Hanger . . .

. . . designed for assembly, disassembly on or off pipe, before or after pipe is in position—*Charles Adams Co., Dept. HPAC, 9 Lexington Dr., Croton-on-Hudson, N. Y.*

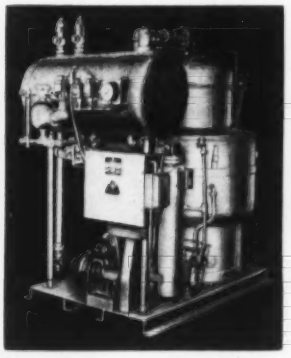
"Adflo" snap-in, adjustable swivel pipe hanger consists of only two parts: yoke of malleable iron; double button head rod of cold-drawn steel. Requires only one standard common square or hex nut which automatically locks against lug on bottom of yoke, locking loop.



Sleeve Bearing . . .

. . . designed for flange or side mounting—*Randall Graphite Bearings, Inc., Dept. HPAC, Greenlawn and Lake*

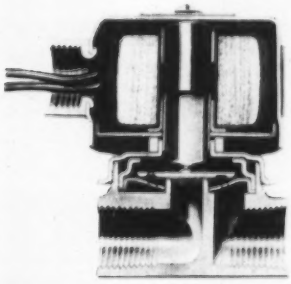
EQUIPMENT DEVELOPMENTS
Continued



Water Tube Boilers . . .

. . . in line designed to fill wide range of heating, air conditioning requirements—*Vapor Heating Corp., Dept. HPAC, 80 E. Jackson Blvd., Chicago.*

"Drum Modulatic" boilers give 150 bhp (5 million Btu per hr), occupy 40 sq ft. Total heating surface of 245 sq ft for 150 bhp results in 1.6 sq ft of heating surface per boiler hp. Unit burns No. 2 and No. 5 oil, gas or combination gas/oil. Available in six sizes from 20 to 200 bhp and operating pressures up to 150 psi, with safety valve setting at 165 psi.



Solenoid Valves . . .

. . . in two new sizes—*Jackes-Evans Mfg. Co., Dept. HPAC, 4427 Geraldine Ave., St. Louis 15.*

Valves of 5/16 and 3/4 in. port diam added to "J Series" of solenoid valves. Series now provides size range 5/16 to 1½ in. port diam. Applications include flow control of water, air, low pressure steam, light oils, brines, LP gases, other non-corrosive liquids. Valves have only two moving parts, pilot operation. Can be mounted in any position, says manufacturer.

Engineers across the country are specifying

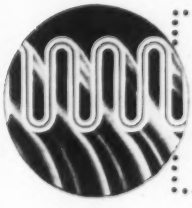
Flexon®

PACKLESS EXPANSION COMPENSATORS

All over the country, for the finest, most modern buildings, you'll find Expansion Compensators written into the heating specifications. Why? Simply because there's no substitute for their completely packless design, their easy installation, and the fact that they *never need maintenance!*

Yes, there's no easier or lower-cost way to take care of pipe and tubing expansion and eliminate water hammer noise, especially in baseboard convector installations. Installed in minutes; you can forget it for the life of the building.

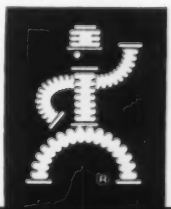
Flexon Packless Expansion Compensators are the modern, low-cost way to absorb pipe motion, proved in thousands of installations. Why not write them into your next job? Write today for the cost data, and the name of your Flexon distributor.



The inside story
2-PLY CONSTRUCTION
The bellows is fabricated from two plies of specially-rolled metal to combine strength with flexibility. Bronze bellows for Model L; stainless steel for Model H.

Send for the complete Flexon Design Guide
Everything you need to know about absorbing pipe motion, in a concise 28-page design guide.

EC-115



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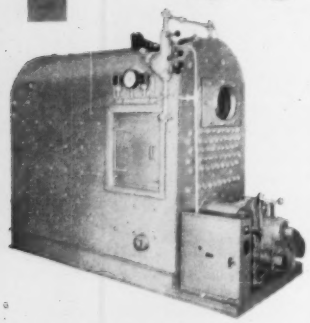
SAVE 3 WAYS with International COMPAK©



Water Tube PACKAGE BOILERS

1. LOWER INITIAL COST

. . . in fact, these International, forced draft package boilers cost less than many modified scotch fire tube package units—yet offer so much more in terms of performance and operating economy.

2. LOWER OPERATING COST

All International COMPAK units are guaranteed to operate at 81% efficiency—with resultant fuel economy. Rapid water circulation through inclined water tubes assures fast generation of steam or hot water—in fact, much faster than modified scotch fire tube boilers.

3. LOWER MAINTENANCE COST

The natural sweeping action of hot gases over staggered rows of water tubes makes COMPAK boilers virtually self-cleaning. When required, full access is provided to *both* the fireside and waterside of all tubes without dismantling the boiler. Maintenance time and costs are kept to an absolute minimum.

The* International COMPAK *also gives you these features:

- Complete Package
- Fully Automatic Controls
- Oil and/or Gas Fired
- Quiet, Smooth Operation
- No Unsightly Stack
- Long Life Expectancy
- Low or High Pressure Design
- Fast Delivery

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Steel Firebox Heating & Power Boilers Low & High Pressure Water Tube Package Boilers • International-LaMont Forced Recirculation Generators • ASME Code Pressure Vessels & Welded Products.

EQUIPMENT DEVELOPMENTS

Continued

Sts., Lima, Ohio.

Bearing series available with company's graphited bronze bushing or with sintered bronze bushing. Both types self-lubricating. One piece housing is 16 gage steel with corrosion resistant cadmium finish. Rubber liner isolates bearing. Available for six standard shaft sizes ½ through 1 in. Bolt size standardized throughout at 5/16 in.

Pipeline Strainer . . .

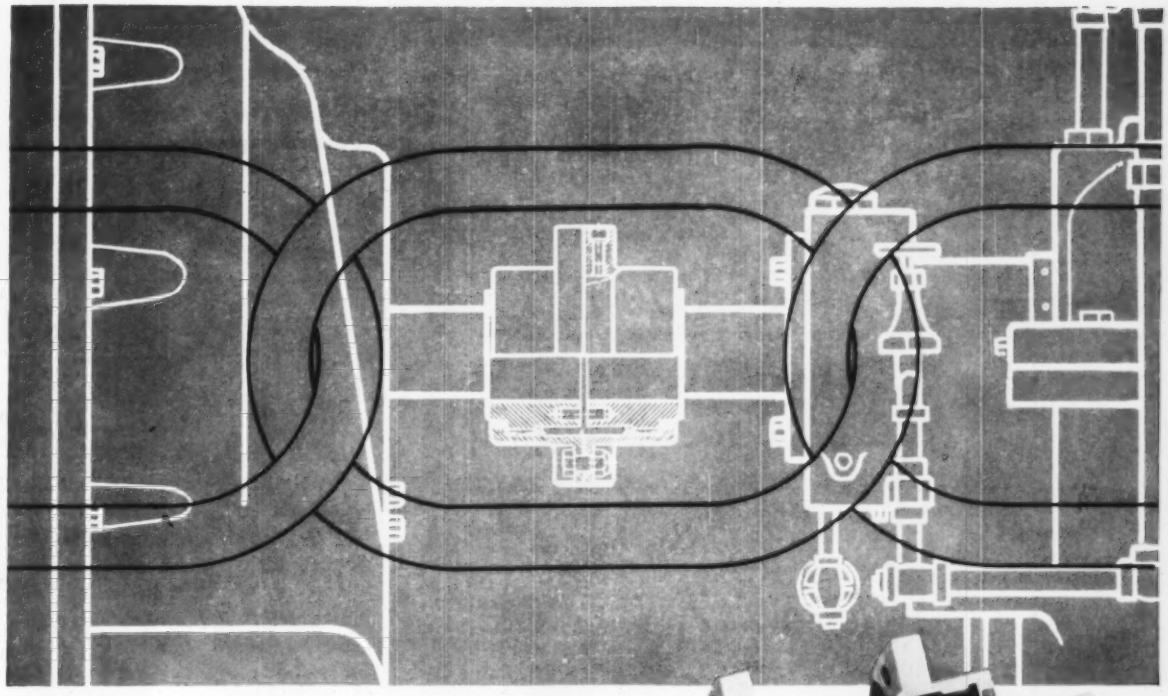
. . . with self-cleaning feature—*Sarco Co., Inc., Dept. HPAC, 635 Madison Ave., New York.*

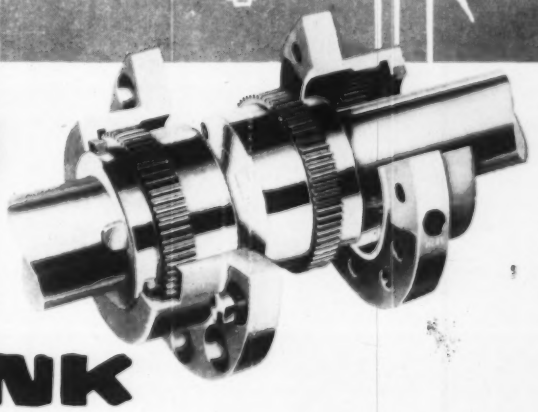
"Type AT" strainer available in sizes ¼ through 3 in. with body construction of semi-steel and spot welded lap seams. Unit has built-in sediment collection chamber integral with cap. The 45 deg design facilitates clearing by blow-off. Strainers are rated for saturated steam or liquids to 250 psi and 475 F total temperature.

Equipment Briefs . . .

CHEMICAL PAINT in new formula combining vehicles, rust-inhibitive pigments, catalytic agent when combined with metal, produces rust inhibitive coating—*Industrial Finishes Co., Inc. Dept. HPAC,* 1119 *Land Title Bldg., Broad and Chestnut Sts., Philadelphia* 10.

RUST PREVENTIVE developed to give positive protection from rust for all types of metal products, machinery—*Lehigh Chemical Co., Dept. HPAC, Chestertown, Md.* "Anderol L-536" rust preventive sprays light film of protection. Product is nontoxic, nonflammable.





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SPECIFY THIS

POWER LINK

When a lot of time and effort have gone into the design of a piece of driven equipment, it makes sense to pick the power link carefully. Take a pump or compressor, for instance. No matter how well it is designed and built, for long service life and operating efficiency, it needs protection against strains due to misalignment.

Waldron gear couplings provide complete protection and positive, trouble-free drive because

They are strong . . . Hubs and cover sleeves for sizes 1¼A through 7A are machined from tough steel forgings. Hubs are keyed to the shafts. The two one-piece cover sleeves function as a single, rigid unit serving as a floating connecting link between the hubs. High strength of forgings makes possible a very compact coupling with low rotating inertia.

They are reliable . . . There are no flexible parts to bend or break and the coupling is dust, moisture, and oil tight. Patented Walflex seal is at the lowest possible diameter where centrifugal force is least. Clearance between teeth in hubs and sleeve is engineered so that an oil wedge always separates them, taking the wear.

They are available . . . Plenty of rough bore couplings, already assembled—on the shelf for *immediate* delivery. Finish bored standard couplings shipped to meet customers' schedules. We are geared up to give you realistic delivery on *any* type of couplings.

Ask for Catalog 57

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A subsidiary of Midland-Ross Corporation

NEW BRUNSWICK, NEW JERSEY

Representatives In Principal Cities
Export Agents—Frazar & Co., New York, N. Y.

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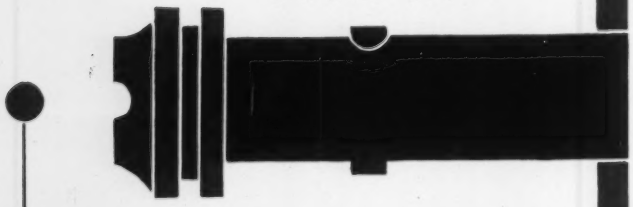
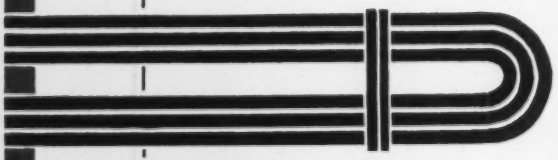
Ellicott has combined its fifty years of building unfired pressure vessels and storage tanks—with ten years of developing a complete line of Novelon Linings of cement, rubber, lead, copper and the new plastic linings that allow much higher heat resistence. Novelon linings solve the corrosion problems in storing and processing water, acid, food and chemicals. Send us your corrosion problem today.





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ELLICOTT
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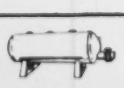
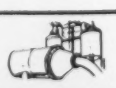

HOT WATER GENERATORS

STORAGE TANKS

SPECIAL LININGS


SPECIAL FABRICATION

Representatives in Major Cities
Clare and Kloman Streets • Baltimore 30, Maryland

formerly NOVELTY STEAM BOILER WORKS, INC.

EQUIPMENT DEVELOPMENTS

Continued

HEATING TAPE developed to protect exposed water pipes, sprinkler systems automatically, regardless of outside temperature fluctuations—*Cox & Co., Inc., Dept. HPAC*, 115 *E. 23rd St., New York* 10. "Automatic Ready Heat" has pre-set thermostat which is integral part of heating tape. Available in four types from 6 to 20 ft in length.

LOUVERS designed to meet ventilation, modern design requirements in industrial, commercial, institutional applications—*E. Van Noorden Co., Dept. HPAC*, 122 *Magazine St., Boston, Mass.* New line of extruded aluminum, weathertight louvers and louver penthouses available in three types: standard stationary; stormproof stationary; adjustable.

REMOTE READING GAGES redesigned, in higher pressure models, to provide wider vision—*Reliance Gauge Column Co., Dept. HPAC*, 5902 *Carnegie Ave., Cleveland* 3. Image of green fluid is carried out in front of face plate by means of protruding plastic reading medium. This enables water level to be read at any angle, even 90 deg from center on either side, says manufacturer. High power illuminator has also been added for better vision.

RUST PREVENTION for all rustable metals—*Arted Co., Dept. HPAC*, 141 *W. 53rd St., New York* 19. "Arrust" is fish oil penetrating coating fortified with special formula rust inhibitor. Can be used directly over firm rusted surfaces without peeling, flaking. Except for severely rusted surfaces, only one coat necessary. One gallon covers 300 to 400 sq ft.

WELDED PIPE in nominal size range ½ through 4 in.—*Jones & Laughlin Steel Corp., Dept. HPAC*, 3 *Gateway Center, Pittsburgh* 30. Continuous weld pipe intended for heating, air conditioning, sprinkler, electrical conduit applications. ≠

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Republic ELECTRUNITE Stainless Steel Pipe in types 304, 304-L, 316, 316-L, 321 and 347—plus other analyses. Continuous welded sizes from ⅛" I.P.S. through 2" I.P.S. in A.S.A. schedule 40S; from ⅛" I.P.S. through 4" I.P.S. in schedule 10S; and from ½" I.P.S. through 4" I.P.S. in schedule 5S wall thicknesses. Larger sizes up to 30" also available. And you can get Republic Stainless Steel Tubing in a complete range of sizes and analyses.

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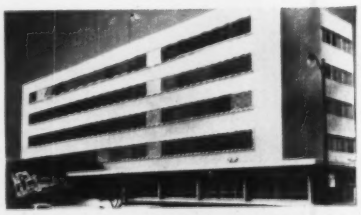
you can design for 100% air recirculation

It's being done every day, with Barnebey-Cheney activated charcoal to purify recirculated inside air. And the savings in heating and cooling costs, as well as reduced initial investment, are substantial. You may, of course, bring in outside air for pressurization or design for less than 100% recirculation for specific reasons. Write today for Bulletin T-323. Barnebey-Cheney, Columbus 19, Ohio.

Business increased when this savings and loan company freshened the air in its formerly musty deposit box vaults.

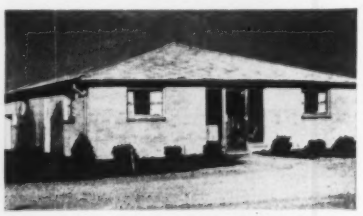
High velocity system handles 87,000 cfm; 74,000 cfm is recirculated, 40% through B-C filters, at Houston Medical Towers.

$12,000 was saved in heating installation for this church and school; heating costs cut $1,650 per year, with B-C filters.



B-C permitted reducing outside air intake to 5% in this California Teachers Association building, Los Angeles.

Over 200 B-C filters handle 218,000 cfm in conjunction with electrostatic filters at this Dallas auditorium.



The characteristic aroma of a veterinary hospital is missing from this one, thanks to B-C activated charcoal.

activated charcoal air purification

Barnebey Cheney

RECENT TRADE LITERATURE...

▸ *AIR CONDITIONING UNIT*—Bulletin "No. 870" describes new line of "Multi-Zone" air conditioning units in eight sizes 3400 to 36,000 cfm. Publication is 8 pages long, contains description of components, accessories, capacity and specification data. "Roll-O-Vent" automatic filter used in line featured. *American Air Filter Co., Dept. HPAC, 215 Central Ave., Louisville.*

▸ *AIR DIFFUSERS*—Selection tables, performance charts, engineering data for company's "Multi-Pattern" air diffusers given in 64 page book. Each type illustrated in accompanying figure. Also includes diagrams. *Universal Diffuser Corp., Dept. HPAC, 38 Marbledale Rd., Tuckahoe, N. Y.*

▸ *AIR FILTER*—Performance, advantages of "Hi-Kleen" two stage, disposable media filter outlined in illustrated data sheet. Details of design, construction, installation, maintenance given with diagrammed specifications. *Farr Co., Dept. HPAC, P. O. Box 45187, Airport Sta., Los Angeles 45.*

▸ *ALL-YEAR USE OF SCHOOLS*—Bulletin "600-A12," distributed by manufacturer outlines pros, cons of year 'round use of school buildings. Publication points out schools may be used in summer for adult education, also for enrichment program for gifted students. Company's equipment also presented. *American Air Filter Co., Inc., Dept. HPAC, 215 Central Ave., Louisville 8.*

▸ *BALL VALVES*—Booklet describes line of "Double-Seal" ball valves. Data sheets cover each of seven models in text, pictures, diagrams, specification charts. Complete set of engineering drawings also included. *Jamesbury Corp., Dept. HPAC, 48 New St., Worcester, Mass.*

All

WATERLOO

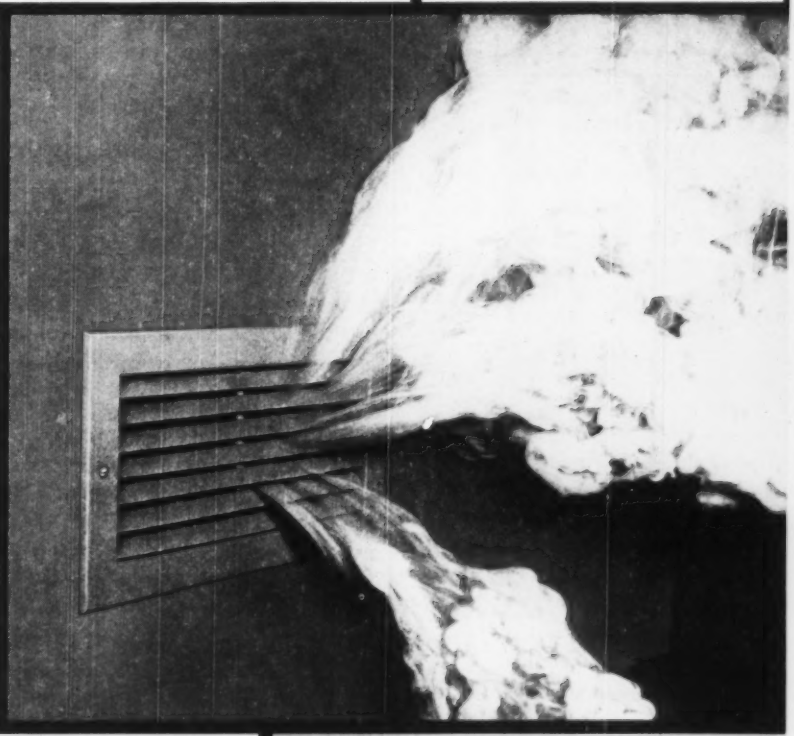
Registers and Grilles are tested and approved by

ANEMOSTAT®

Laboratories

TESTED • APPROVED • ANEMOSTAT CORPORATION OF AMERICA

This smoke test picture, illustrating the exhausting of room air through Waterloo style 3H Return Air Grille, was taken in the Anemostat Laboratories in Hartford, Connecticut. It is one of a series of tests conducted by Anemostat research engineers to insure maximum efficiency of Waterloo equipment. In installations throughout the country, Waterloo registers and grilles are used with Anemostat air diffusers — a combination that results in top-quality performance.



Waterloo supply registers and grilles feature the exclusive silent flow "tear drop" louvre design. They are manufactured in a modern plant using the most efficient techniques, and every Waterloo unit is backed by 56 years of experience in air conditioning, heating and ventilating applications. • These, plus Waterloo's wide range line and fast service on specials, are good reasons why it pays to install Waterloo units in your next job.

Write for Waterloo Catalog, containing complete data.

WATERLOO

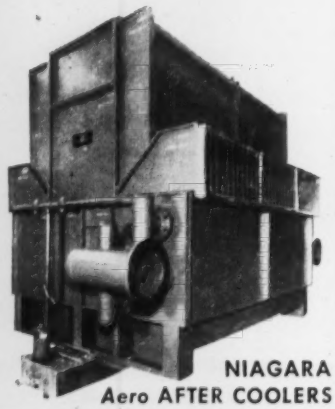
REGISTER CO., INC.

WATERLOO, IOWA

WR-103

REGISTERS • GRILLES • VOLUME CONTROL DAMPERS • DOOR VENTILATORS

ECONOMICAL COOLING OF GASES and COMPRESSED AIR



● Cooling gases or cooling and removing moisture from compressed air, the Niagara *Aero* After Cooler offers the most economical and trustworthy method. Cooling by evaporation in a closed system, it brings the gas or compressed air to a point close to the ambient temperature, effectively preventing further condensation of moisture in the air lines. It is a self-contained system, independent of any large cooling water supply, solving the problems of water supply and disposal.

Cooling-water savings and power-cost savings in operation return your equipment costs in less than two years. New sectional design reduces the first cost, saves you much money in freight and installation labor and in the expense of upkeep.

Niagara *Aero* After Cooler systems have proven most successful in large plant power and process installations and in air and gas liquefaction applications.

Write for Descriptive Bulletin 130

NIAGARA BLOWER COMPANY

Dept. HP-10, 405 Lexington Ave.
NEW YORK 17, N. Y.

District Engineers in Principal Cities of U. S. and Canada

RECENT TRADE LITERATURE

Continued

▶ *BASEBOARD INSTALLATION*—"New Slant on Cutting Baseboard Installation Costs" is title of 12 page booklet based on field information on installations, applications. Installation of baseboard system described in detail. *Slant-Fin Radiator Corp., Dept. HPAC, 87-49 130th St., Richmond Hill 18, N. Y.*

▶ *CABINET AIR CONDITIONERS*—Newly issued 20 page bulletin "2900" contains construction and selection details, arrangement diagrams, capacity information on seven new cabinet air conditioning units. New line has air volume range 200 to 1400 cfm, cooling capacity of 1 to 5 tons, heating capacity 25 to 100 MBH. *Ilg Electric Ventilating Co., Dept. HPAC, 2850 N. Pulaski Rd., Chicago 41.*

▶ *CENTRAL STATION AIR CONDITIONING*—New 50 page bulletin provides information on units for filtering, washing, heating, cooling, dehumidifying, circulating air. Central station units in floor, ceiling types and in 36 sizes 400 to 40,000 cfm capacities. Bulletin contains photographs, engineering drawings, construction details, dimensions, performance tables, other information. *Marlo Coil Co., Dept. HPAC, 7100 S. Grand Ave., St. Louis 11.*

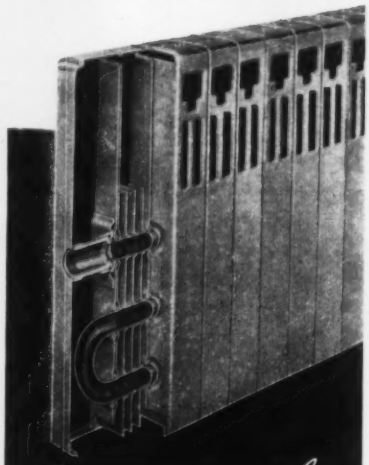
▶ *CENTRIFUGAL PUMP*—Two new bulletins describe company's latest "1531" and "1510" series pumps. Selection information, component parts, quality and service features given in detail with cutaway photos and diagrams. *Bell & Gossett Co., Dept. HPAC, 8200 N. Austin Ave., Morton Grove, Ill.*

▶ *CENTRIFUGAL FANS*—Bulletin "257-S" presents four new airfoil centrifugal fans which increase company's line to capacities of 55,152 cfm. Bulletin gives information on varieties of speed control on both direct connected or belt driven fan

2 kinds of heat

RADIANT and CONVECTED

from SHAW RADIATORS



always *properly* distributed in the room!

Shaw Radiators "heat-condition" a room for *natural* comfort by delivering *radiant* heat that warms solid objects, and *convected* heat to warm the atmosphere.

This AIR-e-ATED Radiant Heat, exclusively Shaw's, is distributed in unvarying, health-guarding proportions that only Nature—*at her best*—can rival.

AIR-e-ATED Radiant Heat is the result of Shaw's fully self-contained construction, featuring full length steel heating fins and exterior radiant panels *all tightly bonded to the copper heating coils.* Shaw units—panel or baseboard—are but 3" thick, easily handled and installed. Choice of same end or opposite end tapping permits simplified piping, lower piping costs. Hot water or steam may be used up to 150 psi.

Write today for free literature

SP-17

SHAW-PERKINS MFG. CO.

201 EAST CARSON ST., PITTSBURGH 19, PA.

NOW...WELD OR BRAZE FOR FASTER, LOWER COST PROCESS LINE ASSEMBLY

Speedline® ALIGNING CONNECTORS ALSO INSURE POSITIVE PIPE ALIGNMENT

No pipe misalignment or "icicles" at joints with Speedline Stainless Steel Aligning Connectors. This inexpensive connector fits over stainless pipe and *Speedline Fittings*, to permit speedy welding or silver brazing of tight, leakproof, socket type joints. In-place preassembly for positive alignment *prior* to welding or brazing, reduces installation time and costs for the most complicated process piping systems.

Speedline Aligning Connectors also make it easy to tie in low cost, light wall Schedules 5 or 10 stainless pipe and *Speedline Fittings* with existing heavy wall lines. The extra straight section on *every* end of *every* Speedline corrosion resistant fitting allows for *direct* assembly of Aligning Connectors to any or all ports of the fittings.

Learn how Speedline Aligning Connectors and the *complete line* of Speedline stainless steel fittings can provide process piping economy and efficiency never possible with conventional fittings. Write for a copy of "Speedline Catalog" today, at no obligation.

Speedline®

® REG. T.M. OF HORACE T. POTTS COMPANY

STAINLESS STEEL FITTINGS

THE NEWEST THING IN PIPELINE ECONOMY

Manufactured by **HORACE T. POTTS COMPANY** • 576 E. Erie Avenue • Philadelphia 34, Penna.

TYPE AL furnace limit control

Adjustable and non-adjustable. Bimetal sensing element is maintained in a completely exposed position in the air stream for fast temperature response. Temperature calibration and differential can be preset to your specifications up to 300° F. Standard factory differential is 25° F. Can be supplied with a closer or wider differential on request. Adjustable feature at no extra cost. Standard range of adjustment is 90° F. 40° F. range also available. Furnished with either 3-inch (AL-3) or 7-inch (AL-7) probe.

NEW
THERM-O-DISC
THERMOSTATS
for furnace fan and limit control applications

TYPE AF furnace fan control

Available with either a 3-inch (AF-3) or 7-inch (AF-7) probe which maintains the bimetal sensing element in a completely exposed position in the air stream. This rapid response position of the sensing element, combined with a snap-acting switch mechanism, provides fast and efficient furnace fan control. Adjustable with a range of 90° F. Maximum temperature 300° F. Factory differential is 25° F. Can be supplied with a closer or wider differential on request.

for additional information . . . write

Therm-O-Disc

THERM-O-DISC, INCORPORATED mansfield, ohio

RECENT TRADE LITERATURE *Continued*

models, construction data, specification data, capacity tables. *Ilg Electric Ventilating Co., Dept. HPAC, 2850 N. Pulaski Rd., Chicago* 41.

▸ *CHECK VALVES*—Brochure with photos, cutaway drawings presents line of bronze, iron body check valves. Descriptions, service recommendations included. *Fairbanks Co., Dept. HPAC, 393 Lafayette St., New York* 3.

▸ *CLAY PIPE*—"Slip-Joint" clay pipe described in new, illustrated reference folder. Publication includes data on handling, installation. Pipe features cited: asphalt compound rings with flat, tapered surfaces factory cast on spigot and inside bell. When painted with solvent, shoved together, compound fuses to form seal. *Robinson Clay Product Co., Dept. HPAC, 65 W. State St., Akron 9, Ohio.*

▸ *CLAY PIPE*—New, 4 page bulletin, "Vitrified Clay Products," contains installation data, specifications, dimensions for manufacturer's line of clay pipe. Illustrated, prepared for quick reference. *Robinson Clay Product Co., Dept. HPAC, 65 W. State St., Akron 9, Ohio.*

▸ *COAL-FIRED STEAM GENERATOR*—New bulletin "No. 1100" gives complete details, specifications on "Coal-Pak" automatic bituminous coal fired water tube package generators. "Type PSL" for 15 psi steam and 30-160 psi water and "Type PSH" for 125, 150, 200 psi high pressure water or steam both covered in illustrated publication. *International Boiler Works Co., Dept. HPAC, 5 Birch St., East Stroudsburg, Pa.*

▸ *COIL SELECTION*—New method of selecting central station air conditioning equipment presented in chart for converting entering and leaving air wet bulb conditions to apparatus dewpoint or effective surface temperature of exact coil for job. From this data, circuiting of coil, water quantity and pressure drop can be picked from rating tables in new catalog for two new lines of company's central station air conditioning units. Catalog, chart available from manufacturer. *Carrier Corp., Dept. HPAC, Carrier Pkwy., Syracuse 1, N. Y.*

▸ *COMBINATION SYSTEM*—New, illustrated 12 page bulletin gives detailed information on company's "Combinex" central system of combined heating, air conditioning, ventilating. System is recommended by

ANOTHER ***PARACOIL*** *PRODUCT*

TYPE "VUF"

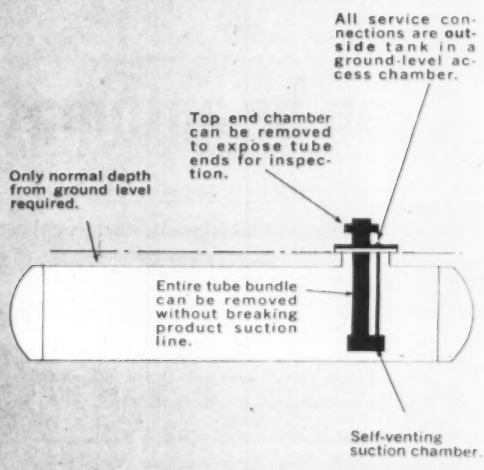
VERTICAL TANK SUCTION HEATER

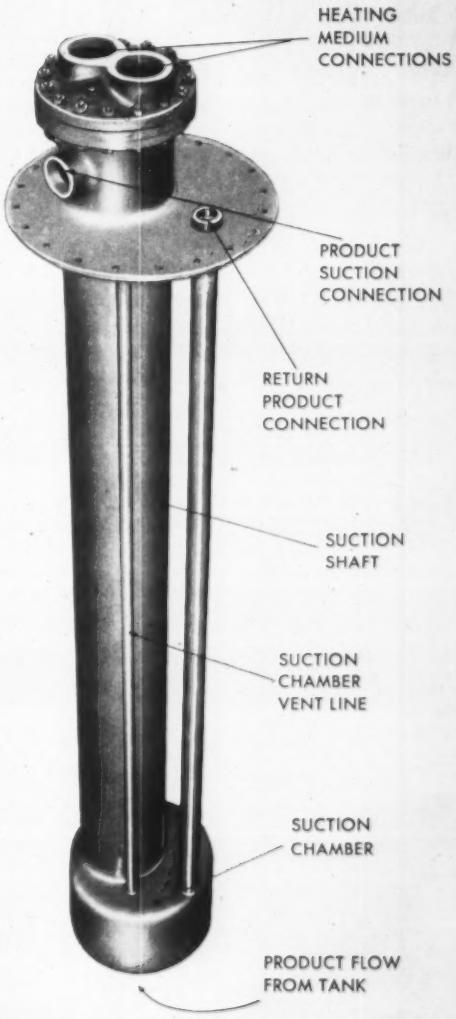
for underground storage tanks

Designed to simplify both installation and service. Heater is suspended from tank manhole flange. **All connections are outside the tank.**

Uses hot circulated fluids as heating mediums — insuring positive suction temperatures.

The simplest method of preheating fuel oils and other viscous liquids in underground storage tanks.


All service connections are outside tank in a ground-level access chamber.
Top end chamber can be removed to expose tube ends for inspection.
Only normal depth from ground level required.
Entire tube bundle can be removed without breaking product suction line.
Self-venting suction chamber.



Hot return product mixes with fresh product in suction chamber, providing an initial temperature rise even before the heating tubes are reached.

Available in standard sizes and capacities for various product fluids.

Alternate Model (Type VSS) employs high pressure steam as the heating medium.

Write for Bulletin 60-J1

DAVIS ENGINEERING CORPORATION

30 Rockefeller Plaza, New York 20, New York • Circle 6-5650

RECENT TRADE LITERATURE

Continued

manufacturer for applications in apartment buildings, hotels, hospitals, motels, office buildings. *Kritzer Products, Div. of Peerless of America, Inc., Dept. HPAC, 5800 N. Pulaski Rd., Chicago.*

▸ *CONDENSER TUBES*—New 10 page technical bulletin, "Cold Drawn Wrought Iron Heat Exchanger and Condenser Tubes," cites applications, gives table of tube sizes with calculated weights, internal, external working pressures, over and under OD tolerances. Information also given on installation procedure. *A.M. Byers Co., Dept. HPAC, Box 1076, Pittsburgh 22.*

▸ *CONDENSING UNITS*—Illustrated 4 page specification sheet gives information on company's line of package, heavy duty and water cooled condensing units. Complete capacities, specifications for all models given with photos of various condensers. *Lehigh Mfg. Co., Div. of Lehigh, Inc., Dept. HPAC, Easton, Pa.*

▸ *COPPER TUBE JOINTS*—New 8 page brochure, "Soldered and Brazed Joints in Copper Tube for Refrigeration and Air Conditioning Systems," covers selection of materials for soldering, brazing copper tube used in air conditioning, steps involved in each operation with general suggestions, comments. Publication illustrated with photos. *Copper & Brass Research Association, Dept. HPAC, 420 Lexington Ave., New York 17.*

▸ *DRAFTING TEMPLATES*—Illustrated 8 page catalog of drafting templates presents company's full line of symbol, circle, ellipse, alphabet, other templates. Size, scale, description, uses, price shown for each of 28 different drafting templates, sets. *Timely Products Co., Dept. HPAC, Box 116, Basil, Ohio.*

▸ *FANS*—Revised catalog "230" presents features, ratings, dimensions, construction data, recommended specifications on company's line of fans and blowers. *Peerless Electric Co., Fan & Blower Div., Dept. HPAC, 1401 W. Market St., Warren, Ohio.*

▸ *FANS*—New bulletin describes company's line of fans, blowers, ventilators capable of air movements 220 to 324,960 cfm. Illustrated publication gives detailed information on products, applications and contains chart showing size, capacity of each item. *Chicago Blower Corp., Dept. HPAC, 9867 Pacific Ave., Franklin Park, Ill.*

▸ *GAS UNIT HEATER*—Catalog "No. 162" illustrates, describes five new gas fired unit heaters. Pictorial, written description includes dimensions, specifications, ratings. *Henry Furnace Co., Dept. HPAC, Medina, Ohio.*

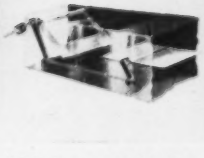
Coal *has always been dependable* now it can be automatic

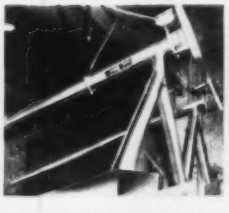
Will-Burt Hopper and Bin Feed Model Stokers — capacities, 150 through 750 lbs. per hr.

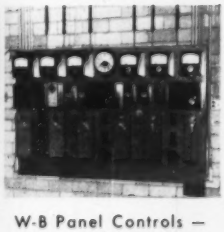
A Will-Burt coal heat installation will *bring coal from bin to stoker . . . feed the necessary coal at any of three adjustable rates . . . and automatically adjust air supply minute by minute, to fuel bed needs.* Panel controls by Will-Burt will *automatically cycle one stoker, or several.*

What could be more practical — especially when you consider the known economy and safety of coal fired heat?

Our Controlled WILL-BURT STOKER







WILL-BURT STOKERS
Box 902 ORRVILLE, OHIO

W-B Automatic Air Control — sensitively controls air supply — prevents excessive soot or smoke.

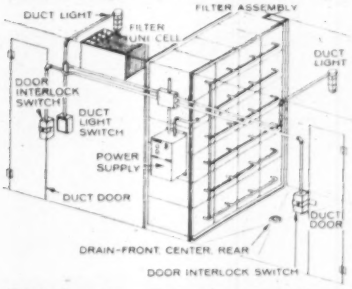
W-B Coal Conveyor — practical for any installation — operates at any angle — single, dual, or cross feed tandem.

W-B Panel Controls — make scheduled heating a simplified, supervisory operation — tailored to the job.

News About Air Filters

NEW HIGH VELOCITY ELECTRONIC AIR CLEANER

for removing dirt particles of sub-micronic size in ventilating and air conditioning systems.



This two-stage electrostatic air cleaner removes smoke, fumes and carbonaceous matter in particle sizes down to 1/100 micron. Handles 50% more air than conventional designs to conserve space and cost of installation. Dirt-cleaning efficiencies range from 85% to 90% at face velocities up to 600 fpm and up to 98% at lower face velocities.

Employs ionizing section to charge air and dirt particles and separate plate section to collect oppositely charged particles which accounts for its high cleaning efficiency and high dirt-holding capacity.

Constant, low pressure drop inherent with this type of cleaner assures consistent rate of air flow to air conditioning systems.

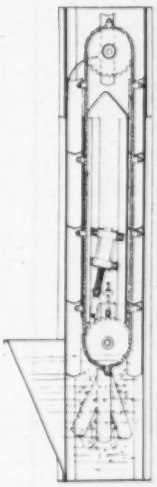
Simple design, utilizing building block construction, eliminates cost and installation of holding frames. Uses selenium rectifier to eliminate need for vacuum tubes.

Provisions made for periodic cleaning with automatic, semi-automatic or manual washing.

Write for Catalog EMC-1055. **AIR-MAZE CORPORATION**, Cleveland 28, Ohio.

SELF-CLEANING AIR FILTER

automatic rotating double-wall panel curtain available with air or electric drive.



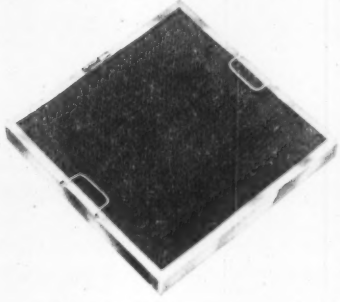
The panels in the Automaze curtain type filter are cleaned and recharged automatically with adhesive. A rotating curtain that holds individual panel filters submerges the panels in an oil reservoir on a timed cycle to dislodge and deposit accumulated dirt in the reservoir. As a result, the Automaze stays clean indefinitely to maintain uniform air flow.

Automaze goes 3 to 6 months without attention, a major improvement over stationary filters that normally need cleaning once a month. Only servicing needed is to remove sludge every six months.

Where compressed air is available, Automaze can be furnished with pneumatic drive. Electric drives are available for standard line current specifications. **AIR-MAZE CORPORATION**, Cleveland 28, Ohio.

HIGH VELOCITY AIR FILTER PANELS

all-metal, permanent, washable panels for ventilating and air conditioning systems.



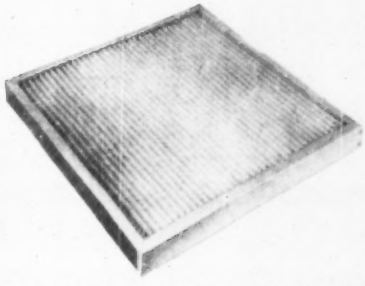
Turboflow action of these filter panels handles 50% more air (up to 3 cfm per square inch gross area) than conventional panels, with high filtering efficiency up to 600 fpm face velocity.

This P-5 Air-Maze panel filter has low static pressure drop, extra large dirt-holding capacity, requires less servicing than ordinary filter panels.

All-metal media of the P-5 has layers of crimped wire screen with "Z" channels stacked 180° to each other so only the nodes touch. Result is a myriad of passages that provide high turbulence by sharp diversions in air stream, causing highly effective wiping action to impinge dirt on adhesive coated baffles.

Write for Bulletin P5-157. **AIR-MAZE CORPORATION**, Cleveland 28, Ohio.

NEW DRY-TYPE WASHABLE AIR FILTER



A new air filter by Air-Maze combines the efficiency of a dry, oilless, completely washable panel with a greatly extended filtering surface for longer service life. Has over 8 times the effective surface area of a conventional panel. Especially efficient in removing lint from recirculated air, and for applications where oil vapors cannot be tolerated.

Special screen grids on both sides of filter permit lint to be brushed off several times before washing is necessary. Filter offers complete washability in cold water. May also be cleaned with a vacuum nozzle.

Made of corrosive-resistant materials—aluminum screen and polystyrene-bonded fiber glass media in galvanized channel.

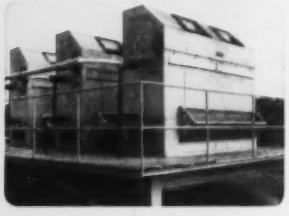
Available in 2" thick panels—16" x 20", 16" x 25", 20" x 20", and 20" x 25" sizes. Write for Bulletin P70P, **AIR-MAZE CORPORATION**, Cleveland 28, Ohio.

MODERNIZING?

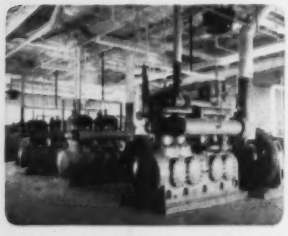
Check FRICK Refrigeration FOR ALL YOUR NEEDS

- [V] CONDENSERS
- [V] PIPE COILS
- [V] SHELL-ICE MAKERS
- [V] VALVES & FITTINGS
- [V] ICE RESERVE UNITS
- [V] AIR HANDLING UNITS
- [V] SHELL & TUBE COOLERS
- [V] "ECLIPSE" COMPRESSORS
- [V] HEAVY-DUTY COMPRESSORS
- [V] QUICK-FREEZING SYSTEMS
- [V] "INSTANT" WATER COOLERS
- [V] MULTI-STAGE COMPRESSOR SYSTEMS
- [V] LOW PRESSURE REFRIGERATION UNITS
- [V] AUTOMATIC CONTROLS & DEFROSTING SYSTEMS
- [V] [V] COMPLETELY ENGINEERED SYSTEMS, DELIVERED AND INSTALLED

Please meet us at the International Heating and Air Conditioning Exposition—Philadelphia. SPACE 309



Frick Evaporative Condensers Save Up to 95% of the Water Used.



Frick Heavy-Duty Four Cylinder Compressors Can Be Adapted to Handle Any Type of Refrigerant.

Frick Shell-Ice—Clear Solid Pieces of Curved Ice. Made Automatically, Without Snow or Waste.

It is a proven fact that today's semi- and full-automatic equipment soon saves enough to pay for itself.

Whatever the refrigeration requirements of your plant—quick freezing, ice making, cold storage, humidity control, low temperatures, condensing, air conditioning, or any process cooling . . . Frick engineers will help you modernize your present system or design one to meet your needs.

Frick refrigeration equipment is world renowned for a long trouble-free life of dependable operation. Many Frick compressors have been in operation for over 40 years.

CALL *your nearest Frick Branch or Distributor today. Or write direct to . . .*

DEPENDABLE REFRIGERATION SINCE 1882
FRICK CO.
WAYNESBORO, PENNA., U. S. A.

RECENT TRADE LITERATURE *Continued*

▸ *HEAT EXCHANGER*—Bulletin outlines performance, advantages of double-pipe heat exchanger and is well illustrated. Units have inner "Thermek" tubes, spined to provide maximum number of transfer edges for efficient counterflow action. *Heatron Inc., Dept. HPAC, 333 Eberts Lane, York, Pa.*

▸ *HEAT EXCHANGERS*—Newly revised "Fluid Cooler" sales catalog "S-395" describes company's line of air cooled heat exchangers. One-third of catalog devoted to applications of company's line in industry. Two basic models—vertical or horizontal air flow—and 23 sizes covered in catalog. *Trane Co., Dept. HPAC, La Crosse, Wis.*

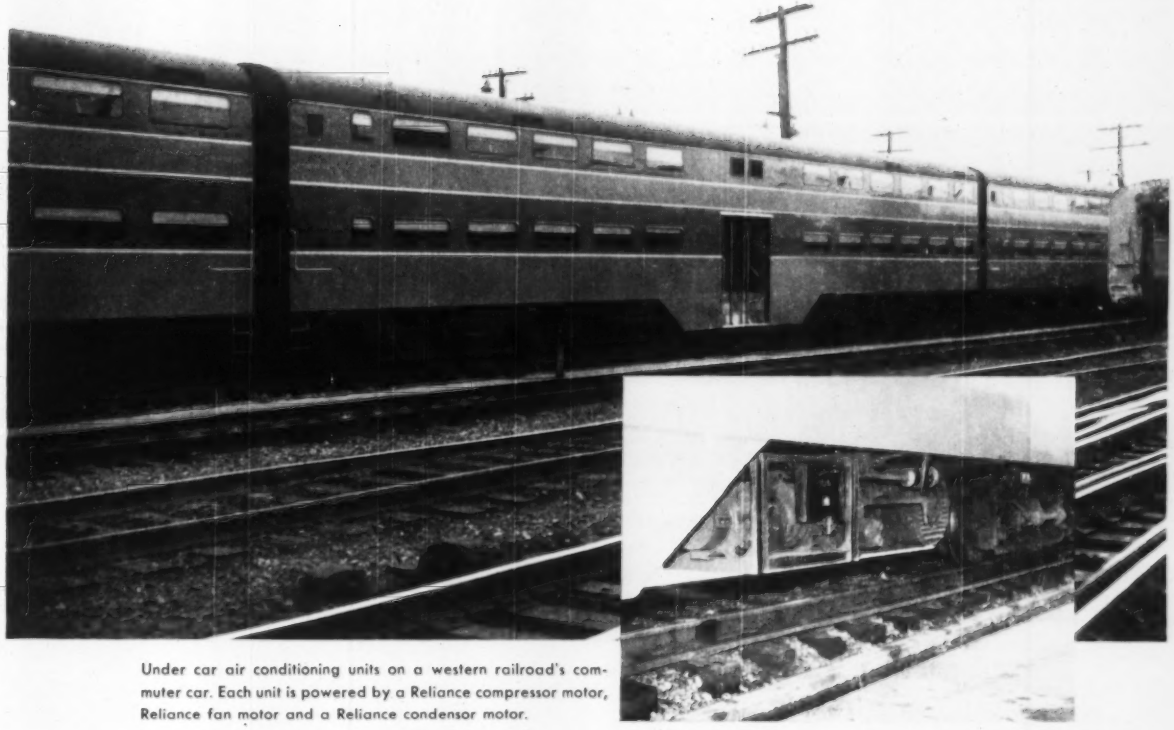
▸ *HEATING-COOLING UNIT* Bulletin "B-2001-B" describes company's line of "Riviera" year 'round single unit conditioners using forced flow convections for heating, cooling. New 28 page publication gives breakaway illustrations, dimensional drawings, cooling and heating capacities, piping diagrams, control schemes, engineering selection and rating data. *Warren Webster & Co., Dept. HPAC, 1664 Federal St., Camden 5, N. J.*

▸ *HOT WATER GENERATORS*—Revised specification sheets with separate section on hot water generators describing company's line. Each of 10 models given with description, specifications, illustrations. *Cyclotherm, Div. of National-U.S. Radiator Corp., Dept. HPAC, 157 E. First St., Oswego, N. Y.*

▸ *HOT WATER HEATER*—File sheet "No. 3460" gives information on direct oil fired hot water heater for commercial needs. Three models, all with 30 gal reserve tanks, available to heat 135, 200, 270 gph. Reference sheet includes specifications and construction diagram. *Petro, Dept. HPAC, 3170 W. 106th St., Cleveland 11.*

▸ *HTHW PRODUCTS*—New bulletin includes specialized application information for engineers on company's lines of heating equipment for high temperature, high pressure, hot water systems. "Model HS Horizontal Unit Heaters," "Model PS Projection Heaters" and "Torrivent Coils" discussed. Included are capacity tables, charts, conversion factors for all size units, methods of calculating capacities over range of conditions, coil selection data, recommended engineering specifications. *Trane Co., Dept. HPAC, La Crosse, Wis.*

▸ *INDUSTRIAL VALVES*—New 28 page condensed version of company's general catalog lists complete line of industrial valves. Valve figure numbers indexed for reference by topics; face to face dimensions supplied in full size ranges. Given for the first time are



Under car air conditioning units on a western railroad's commuter car. Each unit is powered by a Reliance compressor motor, Reliance fan motor and a Reliance condensor motor.

You bet it's rugged service, but Reliance Motors keep these cooling units running

Track ballast, dirt, rain—nothing has altered the top performance of these Reliance Motors, even after three years of operation.

Metermatic bearing lubrication, protected windings, weather proof frames, and just plain good quality have kept these Reliance Motors going under punishing conditions.

Few applications are as tough as this one. But tough or easy Reliance Totally-Protected Motors give years of trouble-free performance with a minimum of maintenance.

Get all the facts on Reliance Totally-Protected Motors from your Reliance Representative, or write today for a copy of "Check the Facts" Bulletin No. B-2401.

B-1592

RELIANCE ELECTRIC AND ENGINEERING CO.

DEPT. 3610A CLEVELAND 17, OHIO
CANADIAN DIVISION: TORONTO, ONTARIO
Sales Offices and Distributors in Principal Cities

RECENT TRADE LITERATURE

Continued

sections on bronze brazed joint valves and corrosion resistant nickel-iron line. *Ohio Injector Co., Dept. HPAC, 275 Main St., Wadsworth, Ohio.*

▸ *INTAKE SCREEN*—Properties, applications of knitted mesh for intake screen outlined in 8 page booklet. Applications also include uses as acoustical material, insulation, gasket material, resilient medium, others. *Metal Textile Corp., Div. of General Cable Corp., Dept. HPAC, 643 E. First Ave., Roselle, N. J.*

▸ *LEAK DETECTORS*—New 12 page publication "GEA-6817" describes in text, tables, pictures the characteristics and applications of leak detectors for locating leaks in system or component under pressure or vacuum. Emphasis given to new control unit to be used with or without any of four detector heads. Contains technical data on types "H-2," "H-3," "H-4," "H-5" detectors with information on accessory equipment. *General Electric Co., Dept. HPAC, Schenectady 5, N. Y.*

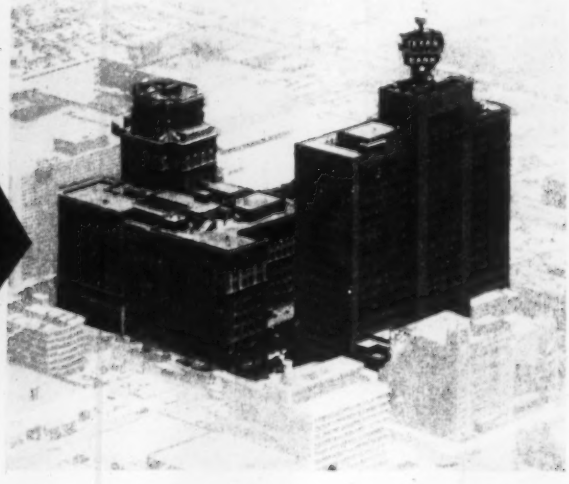
▸ *MASONRY DRILL*—Catalog contains illustrations, specifications of company's line of portable diamond drilling equipment, accessories for drilling in materials such as reinforced concrete, brick, tile, marble, granite, etc. Illustrated with application photos and diagrams. *Truco Masonry Drilling Div., Wheel Trueing Tool Co., Dept. HPAC, 3200-182 Davison Ave., Detroit 38.*

▸ *MOTOR FACTS*—Dimensional data and drawings, standard modifications, slide base dimensions with diagrams, adapter information contained in company's 4 page condensed catalog, "SB-175." Bulletin covers general purpose fractional and integral hp motors from 1/20 to 200 hp. New line of d-c motors 182 through 586 frame sizes included. *Marathon Electric Mfg. Corp., Dept. HPAC, Cherry and Randolph Sts., P. O. Box 630, Wausau, Wis.*

▸ *PIPE FITTINGS*—Illustrated 4 page folder describes company's new line of straight-threaded port fittings designed to save space in confined areas and in making multiple connections. Available in all standard shapes and consisting of swivel body and externally threaded nut, fittings may be installed with standard tools. *Flodar Corp., Dept. HPAC, 16911 St. Clair Ave., Cleveland 10.*

▸ *PIPE INSULATION*—Data giving typical average values on physical, thermal properties of 85 percent magnesia, calcium silicate and diatomaceous silica insulations given in data sheet issued by association's Engineering and Research Committee. *Magnesia Silica Insulation Man-*

Major Oil Company SPECIFIED THERMAL



Two big Thermal central plant units were specified by a major oil company with headquarters in Houston for the year-round air conditioning of its Data Processing System. This same company has many other installations of Thermal air conditioning equipment in its several plants and office facilities.

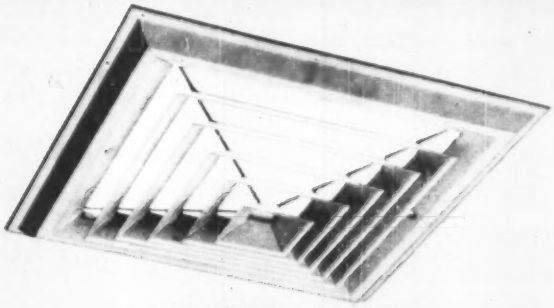
The Thermal line includes central plant air conditioners; multi-zone air conditioners, sprayed coil units; heating and ventilating units, cooling and heating coils and air-cooled condensers. For air conditioning and ventilating equipment that can be relied on for efficiency, long life and economical operation, see your Thermal Engineering agent.

Agents in principal cities.
Quality Products Since 1945.

THERMAL ENGINEERING CORPORATION
2605 W. DALLAS • P. O. BOX 13254

U.S. Offers the Most

AT LOWEST COMPETITIVE PRICES
THE NO. 2500 U.S. STEPPED DOWN AND NO. 2501
FLUSH-TYPE SQUARE CEILING DIFFUSERS-DAMPER AND FRAMES



No. 2500 U.S. SQUARE
STEP-DOWN CEILING DIFFUSER

The No. 2501 FLUSH-TYPE SQUARE CEILING DIFFUSER is of Same Sectional Structure and Same Deep ANTI-SMUDGE OUTER SECTION as the No. 2500 except that the Sections of the No. 2501 are on the SAME PLANE — NOT STEPPED DOWN.

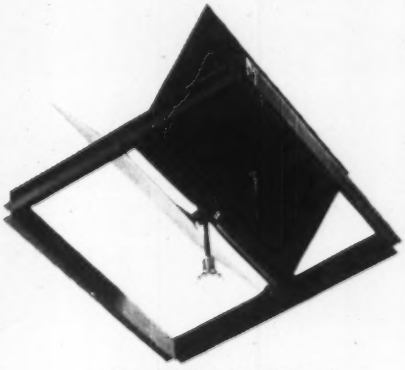
NOS. 2500 and 2501 ARE NOW READY FOR SHIPMENT

NOTE: the WIDE, DEEP OUTER ANTI-SMUDGE SECTION. This Protects the Ceilings against Soilage. The Air Stream is Diverted Sufficiently Downward to Clear the Ceiling and yet Create PERFECT DIFFUSION.

STANDARD FINISH — ART BUFF (prime coat).

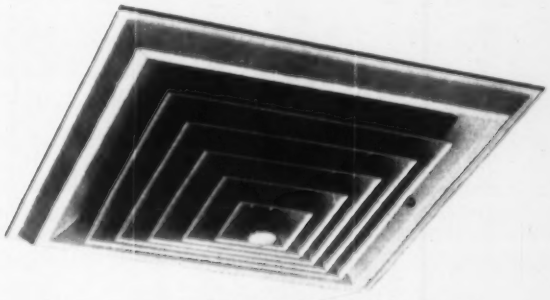
All No. 2500 CEILING DIFFUSERS are Equipped with the Finest Rubber Sealing Gaskets Properly attached to the Outer Rim of ANTI-SMUDGE Section which creates a POSITIVE SEAL against CEILING STREAKAGE.

The Hole in the Center Section Permits SCREW-DRIVER ADJUSTMENT with Tamper-Proof Balancing. Attachable Knob for Convenient Operation. Center Slotted for Ball Chain to pull Square or Round Damper which would be furnished by others. DAMPERS for No. 2500 are KNOB or SCREW-DRIVER OPERATED.



No. 2800 or 2801
SQUARE CEILING DAMPER

TO INSTALL: Set in opening and attach. Remove Knob. Attach Diffuser. Replace Knob for Knob Operation — or discard Knob for SCREW-DRIVER OPERATION.



No. 2500 U.S. SQUARE
CEILING DIFFUSER

The No. 2500 and No. 2501 SQUARE DIFFUSERS PRESENT the MOST VERSATILE and EFFICIENT of all Bi-Valve DAMPERS. KNOB Operation affords Hand Adjustment. SCREW-DRIVER Operation provides Unmolestable Setting. In this case Knob is not needed.

FIT FOR A KING—YET WITHIN REACH OF ALL

INDOOR COMFORT

WRITE FOR OUR COMPLETE NEW CEILING DIFFUSER FOLDER

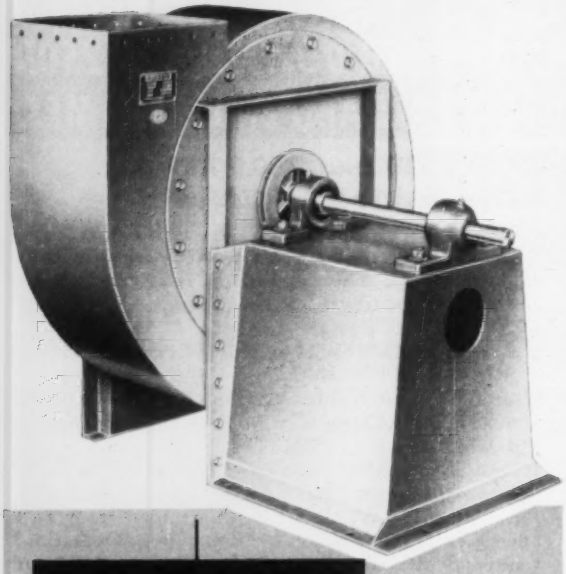
NAAO

UNITED STATES REGISTER COMPANY

BATTLE CREEK, MICHIGAN, U.S.A.

Branches: MINNEAPOLIS • KANSAS CITY • ALBANY

Aladdin
AIR HANDLING EQUIPMENT



TYPE
"EX"
INDUSTRIAL
EXHAUSTER

- RUGGED
- EFFICIENT
- DEPENDABLE

ALADDIN Industrial Exhaust Fans are all-welded steel plate-construction. They are ideal for material handling such as conveying grains, shavings and sawdust, or for dust removal from grinding of buffing wheels. The EX fan is also the first choice for many jobs where fumes, hot air or gasses must be handled by a rugged, efficient, dependable fan.

Write for complete data

ALADDIN HEATING CORPORATION
1111 WEST AVENUE 137 • SAN LEANDRO, CALIFORNIA

RECENT TRADE LITERATURE *Continued*

facturers Association, Dept. HPAC, 1317 F St., N.W., Washington 4, D. C.

▸ *PIPE, VALVE REPAIR*—Bulletin describes company's "Plastic Steel Emergency Repair Kit." Chemical, physical properties of product given. Illustrated case history applications also covered. *Devcon Corp., Dept. HPAC, Danvers, Mass.*

▸ *PIPELINE FILTERS*—Illustrated catalog, sales kit describe new line of industrial filter equipment. Included are 148 page catalog and samples of "cross flow filcron" and "filcron" filters. Catalog illustrated with photos, diagrams, includes filter specifications. *Fram Corp., Dept. HPAC, Providence 16, R. I.*

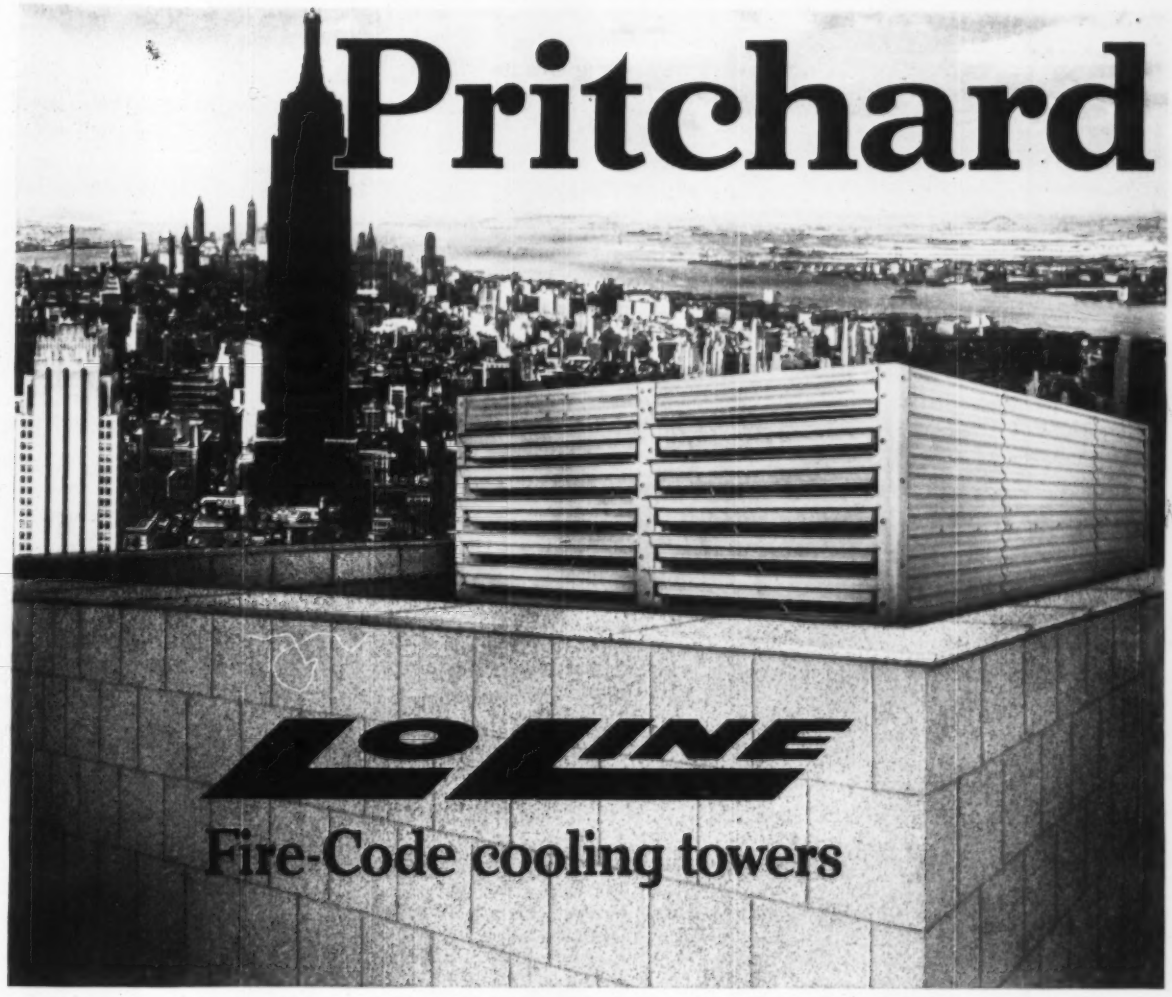
▸ *PLASTIC DUCTS, TANKS*—Bulletin "C-15" describes selection of plastic for various chemical corrosion problems. Physical properties, chemical resistance, equipment applications of various plastics covered with tables, pictures, diagrams. *Haveg Industries, Inc., Dept. HPAC, 900 Greenbank Rd., Wilmington 8, Del.*

▸ *PLASTIC TANKS, DUCTS*—New 8 page brochure describes company's corrosion resistant plastic tanks, ducts, hoods, fans, fume washers, etc. Details of manufacture, physical properties, chemical resistance given. *Corite Products Inc., Dept. HPAC, 6553 W. George St., Chicago 34.*

▸ *PUMP MOTORS*—Recently published manual covers both "Verticlosed Type CFU" oil lubricated and "Type SCU" grease lubricated motors. Outlines procedures designed to minimize dealer's and maintenance man's servicing efforts. Publication illustrated with photos, diagrams, charts. *U.S. Electrical Motors, Inc., Dept. HPAC, P. O. Box 2058, Los Angeles 54.*

▸ *PUMP PARTS*—Booklet, "The Story of Fianite," tells about development, use of thermo-setting non-corrosive material to be used as alternate for certain ferrous, non-ferrous metal parts in pumps manufactured by company. Certain models now manufactured with "Fianite" impellers, diffusers, jet tubes, nozzles on special applications also being made. *Deming Co., Dept. HPAC, 14 Aetna St., Salem, Ohio.*

▸ *REGISTERS, GRILLES*—Illustrated 23 page bulletin presents company's line of registers, grilles, diffusers. Selection information, prices, specifications given in tabular form. Each model shown in photos,



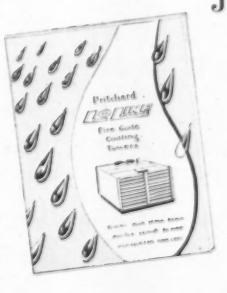
sleek... low... and fire-safe

A Pritchard LoLine Fire-Code cooling tower is not a tower at all. Webster defines a tower as "a building or structure typically higher than its diameter." But the LoLine is less than half as high as its longest dimension. Rather than protrude from your building or grounds like a monstrous growth, defying all attempts at camouflage, the Pritchard LoLine hugs its base, can be smoothly integrated with its surroundings.

Moreover, the Pritchard LoLine Fire-Code cooling tower is safe. A companion to the Pritchard LoLine wood-framed tower, it is designed specifically to meet standard metropolitan fire codes. All structural members are steel. Louvers, casing, water distribution system and fan deck are asbestos cement. There simply is no combustible material exposed to the risk of fire.

It's rugged, too. Corrosion-resistance of steel parts is assured by hot-dip galvanizing *after* fabrication, not before. Only heart-quality California Redwood is used for fill and drift eliminators. Long, trouble-free life is assured. And the tough, asbestos cement board exterior never needs painting. Maintenance is virtually eliminated.

If you would like more information about the 75-ton-and-up Pritchard LoLine Fire-Code cooling "tower," mail coupon for Bulletin 5.2.902. Or consult the Yellow Pages, under "Towers," for the name of your nearby representative.



J. F. PRITCHARD & CO. OF CALIFORNIA
Dept. 104, 4625 Roanoke Parkway, Kansas City 12, Mo.

- ☐ Send bulletin 5.2.902 on LoLine Fire-Code Towers
- ☐ Send bulletin 5.1.902 on LoLine Wood-Framed Towers
- ☐ Please have your representative contact me

Name ..... Title .....

Firm .....

Address .....

City ..... Zone ..... State .....

RECENT TRADE LITERATURE

Continued

drawings. *Universal Diffuser Corp., Dept. HPAC, 38 Marbledale Rd., Tuckahoe, N. Y.*

▶ *RELIEF VALVE*—Illustrated 4 page bulletin "P-33" covers recently expanded line of "230" and "240" safety relief valves for hot water space heating boilers. Bulletin contains diagrams, basic facts on selection, installation of relief valves. *McDonnell & Miller, Inc., Dept. HPAC, 3500 N. Spaulding Ave., Chicago 18.*

▶ *RELIEF VALVE SELECTOR*—"Capacity Computer" and "Relief Valve Selector" for refrigerant pressure vessels available from manufacturer. Computer determines code capacity, number, pressure setting of relief valves for refrigerant pressure vessels from dimensions, design working pressures, type of refrigerant used. Selector determines correct size of valve and size, maximum length of discharge piping in accordance with code requirements. *Henry Valve Co., Dept. HPAC, 3215 North Ave., Melrose Park, Ill.*

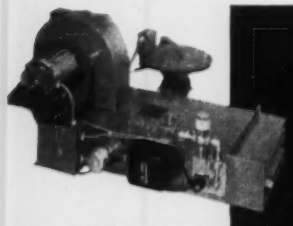
▶ *SOLENOID VALVES*—Bulletin "500 C" includes pictures, description of company's basic types of solenoid valves for range of operating conditions. Low cost models, line of stainless steel valves and series with four independent controls for variable opening, closing speeds, flow control and manual opening all featured. *J. D. Gould Co., Dept. HPAC, 4707 Massachusetts Ave., Indianapolis 18.*

▶ *SPEED REDUCERS*—New 10 page booklet, "Shaft-Mounted Speed Reducers," discusses selection, horsepower ratings, dimensions, construction, installation, maintenance of company's shaft-mounted speed reducing units. Illustrated with photos, cutaway views. *Westinghouse Electric Corp., Dept. HPAC, P. O. Box 2099, Pittsburgh 30.*

▶ *STACK LININGS*—Newly issued bulletin "Form 75" describes monolithic linings for protection of stacks, breechings, utilizing castable refractories. Covers structural, installation features, characteristics of five insulating grades of "Plicast" refractory. Typical installations shown. *Plibrico Co., Dept. HPAC, 1800 Kingsbury St., Chicago 14.*

▶ *STEAM BOILER*—Folder gives general specifications, sizes of company's "Model 77-E Immersion Steam Boilers" in package units 10 to 80 hp. Design of boilers, hot water heaters said to insure quiet operation, freedom from backdraft hazards with completely automatic operation. *Sellers Engineering Co., Dept. HPAC, 1876 N. Clark St., Chicago 40.*

▶ *STEAM TRAPS*—New 40 page engineering manual available to as-



Power Multuri burners available in standard units with input capacities to 19,600,000 BTU's. Larger burners or special adaptations available.

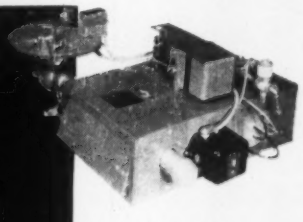
POWER OR ATMOSPHERIC

Multuri Burners

that EXCEED Standards of

EFFICIENCY! PERFORMANCE! SAFETY!

GORDON BYDAND



Multuri Burners available in 4 to 54 mixers. Standard capacities 700,000 to 9,450,000 BTU/hr. Higher capacities available.

ROBERTS-GORDON POWER MULTURI GAS BURNERS

Ideal for commercial and industrial boilers, such as scotch marine, steel firebox, downdraft, refractory types, warm air furnaces, drying units, etc. Power Multuri burners can often be used in conjunction with presently installed stokers or oil burners, permitting quick changeover to auxiliary standby fuel, and can be operated with natural or induced draft.

ROBERTS-GORDON MULTURI (Atmospheric) BURNERS

A PREMIX TYPE GAS BURNER, ideal for commercial and industrial size boilers and warm air furnaces. Gives maximum performance from hard-to-fire Scotch Marine and steel fire box boilers. Controlled flame characteristics make the burner a natural for units with extensive refractory surface. Suitable for any gas at 4" gas pressure or more. Permits high firing rates at high efficiency.

Multuri Burners are completely wired and Assembled — Ready for Immediate Installation. Simple to Install, Adjust, Operate!

Write for detailed information—or for a questionnaire listing all the data necessary for correct specifications and efficient installation.

ROBERTS-GORDON Appliance Corp.

44 CENTRAL AVE. BUFFALO 6, N. Y.

In Canada . . . ROBERTS-GORDON APPLIANCE CORP., LTD., *Grimsby, Ont.*

Gas Heating Equipment

- FURNACES
- COOLING UNITS
- BOILERS
- UNIT HEATERS
- GAS BURNERS

Some things are tough to get at...

That is Professor Tennis C. Williams in the picture. He has concluded, and rightly, that the nesting grounds of the Tyrolean Whooping Manscratcher (the only bird with a poisonous bite) are real tough to get at.

But compared with getting at certain working parts in certain evaporative condensers, the nest of the Manscratcher is as accessible as apple pie in a cafeteria.

That's why service men are sometimes tempted to use burglar tools, and maybe some nitro, when the job calls for getting at inner working parts that need normal servicing from time to time.

On the other hand Recold Dri-Fan Condensers—the best in every other respect too—are engineered for easy access. Just remove a few screws and go right on inside. With Recold's patented access door, spray nozzles and float valves are easy to get at, too.

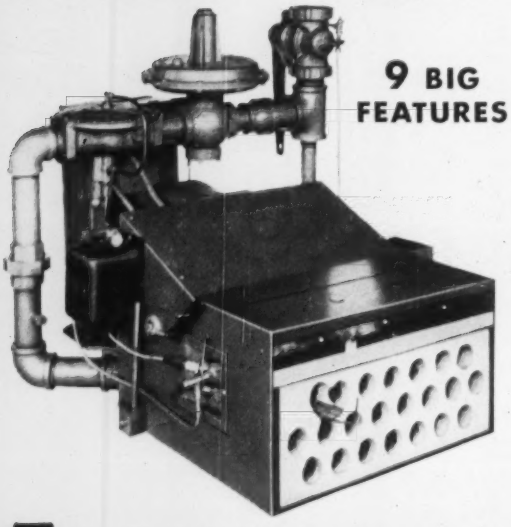
When it comes to inspecting and cleaning drift eliminators—on some condensers the service man yells for a blow torch. To get at the drift eliminators on a Recold Dri-Fan Condenser you just remove the screws and pull them out like a drawer... yet joints are tight and leakproof without gaskets or sealing compounds. It's a matter of engineering and patented design.

Be sure the evaporative condensers you invest in have ACCESS. Be sure you ask for Recold's Dri-Fan!

RECOLD CORPORATION

7250 East Slauson Avenue, Los Angeles 22, California

FOR GAS AND OIL



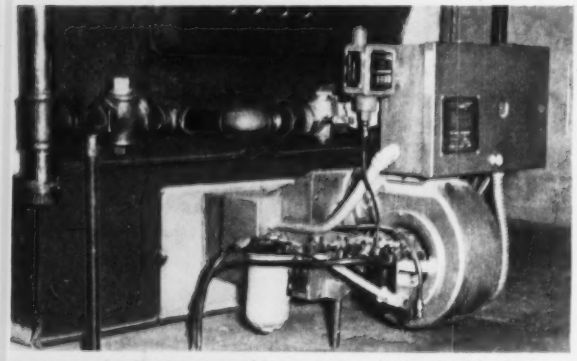
9 BIG FEATURES

LO-BLAST

POWER-TYPE DUAL FUEL BURNER

The finest gas burner...the finest oil burner...now combined in one great unit! Another Lo-BLAST engineering achievement! Check these features—

- **Highest efficiency on either gas or oil.** Lo-BLAST design assures maximum fuel economy.
- **Laminar Flame Oil Burner.** Wide flat flame—no impingement on walls or crown sheet.
- **Fits low base boilers.** Installs through average ashpit door.
- **Reliable—safe.** Factory tested. Underwriters' Laboratories approved.
- **Complete package.** Shipped assembled and wired.
- **Manual or automatic fuel selector.** Damper transfers blower air to either gas or oil burner. Damper position governs switching action to controls.
- **Soft quiet flame.** *Low* pressure combustion air keeps both oil and gas flames quiet.
- **Safety purge cycle.** 30 second purge on each call for heat—also on fuel changeover.
- **No coking or clogging of oil nozzle.** Shield protects oil manifold against reflected heat. Air cooled during gas cycle.



Send now for literature on this sensational new dual fuel burner

MID-CONTINENT
METAL PRODUCTS CO.
1960 N. Clybourn Ave., Chicago 14, Ill.

RECENT TRADE LITERATURE

Continued

sist in sizing, selection, specifying, buying of steam traps, other fluid specialties. Technical information, application recommendations, selection data, illustrations, drawings all included. *V. D. Anderson Co., Div. of International Basic Economy Corp. Dept. HPAC, 1935 W. 96th St., Cleveland 2.*

▶ *STEEL VALVES*—Illustrated 92 page catalog describes line of cast and forged steel valves for power, petroleum, chemical, marine, industrial applications. Application photos of standard valves made by company included. Technical data, rating tables, cross section drawings also given. *Edward Valves, Inc., Subsidiary of Rockwell Mfg. Co., Dept. HPAC, 1200 W. 145th St., East Chicago, Ind.*

▶ *VIBRATION ABSORBERS*—"RH" series of neoprene-in-shear hangers designed for air conditioning installation. Hangers available in four sizes, five diameters, color-coded by capacity. Capacities range 10 to 3000 lb per hanger. Technical dimensional data, load ranges charted in publication. *Vibration Mountings, Inc., Dept. HPAC, 98-15 50 Ave., Corona 68, N. Y.*

for

SPECIFICATION *and* BUYING INFORMATION

Use your complete, up-to-date

JANUARY DIRECTORY ISSUE

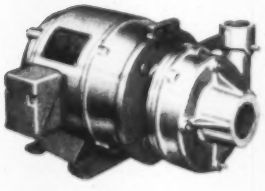
Your job will be a lot easier if you'll keep the January Directory issue of Heating, Piping & Air Conditioning available for handy reference. It's one of your most valuable tools — one which will save you many hours of looking up the products you need for your various jobs. It's the ONE complete, up-to-date, readily accessible source of product information on who makes the blowers, traps, boilers, fittings, specialties of all kinds, etc., you need — and where they're located. They're identified by trade names, too. EVERY product is listed, alphabetically arranged and printed on a distinctive yellow stock for easy reading and reference. Keep it handy . . . it's a time saver.

INSIDE, A 2-HP
FLUIDYNE
END-SUCTION
PUMP...

IT IS *ONE* OF THE
MOST COMPLETE LINE OF
GENERAL PURPOSE
PUMPS

The Peerless Fluidyne end-suction pump line offers characteristics to fit exactly your system's piping. Literally thousands of combinations are available: electric, engine, or belt drives; close or flexible coupled types; HP ranges from ¼ to 150 HP; capacity range from 10 to 5500 gpm; head range from 2 to 260 ft. All Fluidyne pumps are compactly designed, highly dependable in operation, have excellent hydraulic and head-capacity characteristics, make a neat-appearing, trim installation. For complete information on the entire Fluidyne line, mail the coupon today.

PEERLESS *Fluidyne*® REDI-PAK PUMPS



PREPACKED and ready for immediate service, this Fluidyne is one of the 22 popularly sized pumps, from 1 to 15 HP, that comprise the quickly available, economical REDI-PAK line.

Putting Ideas to Work

FOOD MACHINERY AND CHEMICAL CORPORATION
Peerless Pump Division
Plants: LOS ANGELES 31, CALIFORNIA and INDIANAPOLIS 8, INDIANA

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FOOD MACHINERY AND CHEMICAL CORPORATION ®

PEERLESS PUMP DIVISION • FOOD MACHINERY AND CHEMICAL CORPORATION • 301 WEST AVENUE 26, LOS ANGELES 31, CALIFORNIA
Please send Peerless Pump Bulletin No. B-2300 "Peerless Fluidyne Pumps"

NAME_____ POSITION_____

COMPANY_____ ADDRESS_____

CITY_____ ZONE_____ STATE_____

HPAC

RECENT TRADE LITERATURE

Continued

▶ *WATER HEATER*—Folder outlines features of manufacturer's controlled draft gas fired water heater in 4 pages. Heater available in sizes with storage capacities 100 to 565 gal and recovery capacities 96 to 864 gph with 100 F rise. *Sellers Engineering Co., Dept. HPAC, 4876 N. Clark St., Chicago 40.*

▶ *WATER HEATERS*—Company's "FTHW-FMHW" catalog includes information on selection, application of large volume hot water supply. Selection tables for units delivering single, dual, multi-temperature delivery included in 6 page publication. *Federal Boiler Co., Inc., Dept. HPAC, Granite and West Sts., Midland Park, N. J.*

▶ *WATER TREATMENT*—New, 8 page bulletin "1530-A" indicates advantages of hydrogen zeolite process, its chemistry, variations in methods for neutralizing mineral acidity of hydrogen zeolite effluent. Types of zeolites discussed with advantages, disadvantages of various regenerants. *Cochrane Corp., Dept. HPAC, 17th St. below Allegheny Ave., Philadelphia 32.*

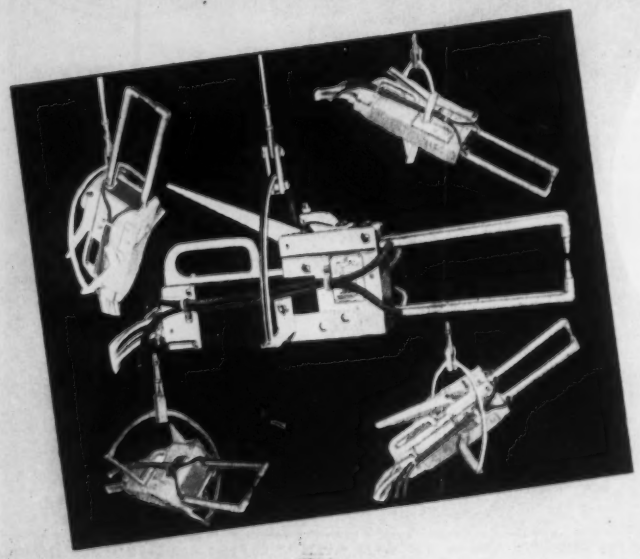
▶ *WELDING FITTINGS AND FLANGES*—Technical bulletin "FD C-264" presents line of fittings, flanges primarily for 8 in. nominal pipe size. Complete dimensions, specifications given in tabular form. Diagram of each item included. *Babcock & Wilcox Co., Tubular Products Div., Welding Fittings Dept. HPAC, Milwaukee 46.*

▶ *WELDING MACHINE*—Recently issued 4 page folder "DM-71" describes combination a-c, d-c inert-gas welding machine in text and illustrations. Publication outlines advantages of machine. *Hobart Brothers Co., Dept. HPAC, Hobart Sq., Troy 1, Ohio.*

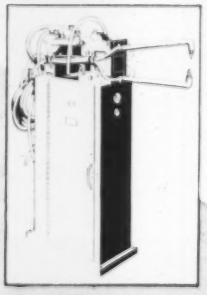
▶ *WROUGHT IRON*—New, illustrated publication, "4-D Wrought Iron, A New Dimension in Corrosion Control," discusses advantages, features of company's latest product development. Illustrated bulletin includes section with graphs showing comparative corrosion resistance of "4-D" wrought iron, standard wrought iron, other ferrous metals. Descriptions of actual installations, applications given. *A. M. Byers Co., Dept. HPAC, P. O. Box 1076, Pittsburgh 30.*

▶ *WROUGHT IRON PIPE*—Air conditioning, radiant heating, snow melting are among piping services, applications discussed in booklet, "Wrought Iron Pipe for Modern School Building," an 8 page illustrated bulletin on wrought iron piping applications. Detailed information on "4-D" wrought iron with improved corrosion resistance included. *A. M. Byers Co., Dept. HPAC, Box 1076, Pittsburgh 30.* ‡

HANDY... any way you look at it



Ball bearing suspension ring takes all the weight and much of the work out of welding with a Miller MPS water-cooled portable spot welder. Choice of manual or air operated models, all with timers. 6" tongs secure work with pressure to 600 pounds. Model MPS-10-KVA weighs 79 lbs., welds up to 3/16" thickness; model MPS-20-KVA, 91 lbs., handles material to 1/4"; air operated models average 53 lbs. more. Wide choice of tongs.



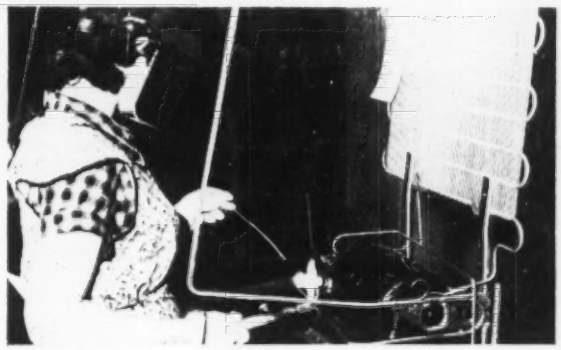
Steel pedestals are available for both models.

miller ELECTRIC MANUFACTURING COMPANY, INC.

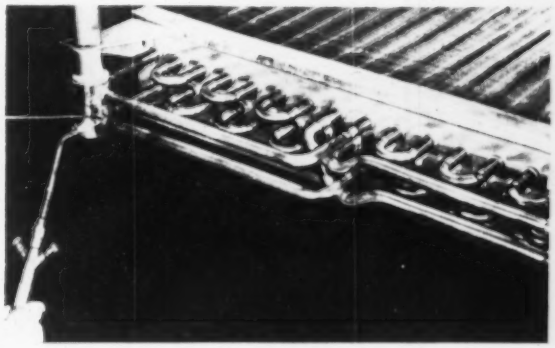
APPLETON, WISCONSIN

distributed in Canada by CANADIAN LIQUID AIR CO., LTD., Montreal

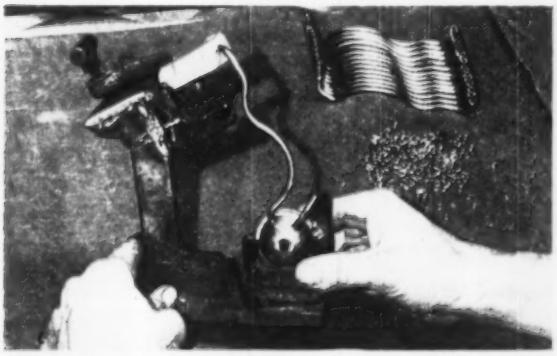
Big names in refrigeration get big benefits from Handy & Harman Sil-Fos and Easy-Flo!



HOTPOINT COMPANY, CHICAGO, for example, uses EASY-FLO 45 in tube joints connecting the major components of many models of HOTPOINT Refrigerators. Metals joined are copper-to-copper, copper-to-steel, and steel-to-steel. Each joint must meet a tensile strength test of 30,000 psi. Joint strength? Variety of metals to be joined? Take a tip from HOTPOINT . . . use EASY-FLO 45.

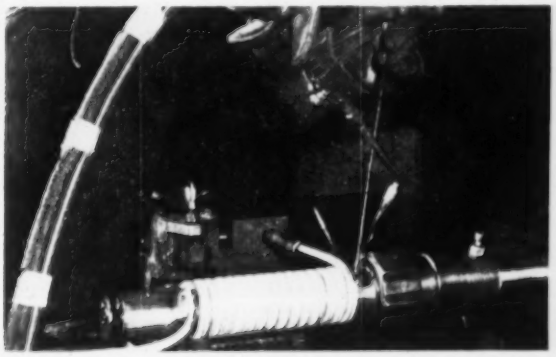


KRAMER-TRENTON COMPANY, TRENTON, N. J., uses SIL-FOS 5 in different models of condensers for a variety of industrial and domestic air conditioners and refrigeration systems. Shown here is their model ED 3200. Each of its 80 joints is SIL-FOS 5 brazed for lifetime leak-tightness. For a smooth-flowing brazing alloy and high economy per joint, SIL-FOS 5 is the "all-around" answer.



TECUMSEH PRODUCTS COMPANY, TECUMSEH, MICHIGAN, makes broad use of EASY-FLO 45 in a number of components for air conditioners, refrigerators and freezers.

For instance, a four-part muffler header sub-assembly used in compressors and consisting of shaped tubing and cast iron is EASY-FLO brazed by preplacing rings of the alloy at the joints and placing the unit in a unique jig for rotary heating. Production rate is 350 assemblies per hour. Speed? Adaptability of jigging? Look to silver alloy brazing . . . spelled E-A-S-Y-F-L-O 45.



EBCO MANUFACTURING COMPANY, COLUMBUS, OHIO, uses *both* SIL-FOS and EASY-FLO 45 in its "Oasis Hot 'N' Cold" water cooler. Five components of this unit are brazed with one or the other of these stalwarts of the refrigeration industry, using both hand torch and induction heating.

Take your pick of silver alloy brazing advantages and apply them to your product and production needs. What you don't see here, ask us about. We invite inquiries on EASY-FLO and SIL-FOS and what they can do for you.

START WITH BULLETIN 20

This informative booklet gives a good picture of silver brazing and its benefits...includes details on alloys, heating methods, joint design and production techniques. Write for your copy.

Your NO. 1 Source of Supply and Authority on Brazing Alloys

HANDY & HARMAN

General Offices: 82 Fulton St., New York 38, N. Y.

DISTRIBUTORS IN PRINCIPAL CITIES

OFFICES AND PLANTS
ATLANTA, GA.
BRIDGEPORT, CONN.
PROVIDENCE, R. I.
CHICAGO, ILL.
CLEVELAND, OHIO
DETROIT, MICH.
LOS ANGELES, CALIF.
OAKLAND, CALIF.
TORONTO, CANADA
MONTREAL, CANADA

That's right LOOK AGAIN

ALL TRAPS are NOT ALIKE

here's why the THERMOSTAT in Sterlco® TRAPS does more for you...

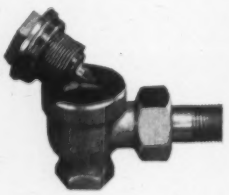
1. If the thermostat is damaged, the spring action closes the trap. Trouble is immediately located because radiation becomes cold — no waste of steam — no searching. Thermostats and seats easily replaced.

2. It compensates for pressure changes — operates satisfactorily even if pressures vary.

3. It cannot be damaged by excessive steam pressures or by freezing.

STERLCO THERMOSTATIC RADIATOR TRAPS

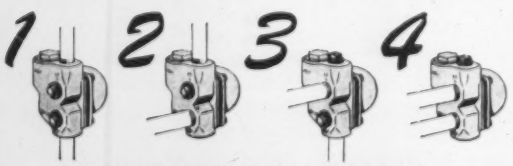
Keep radiators clear of condensate without wasting steam. Sturdy bronze bodies and covers—replaceable seats. Angle, Straightway, Corner or Vertical styles.



STERLCO FLOAT and THERMOSTATIC TRAPS

Ideal for installation and rehabilitation of unit heaters. Dependable, compact, large capacity, easy servicing and rugged construction makes Sterlco F & T's outstanding performers on unit heaters and other steam heating equipment.

Install the 3/4" 69B in the most convenient way



STEAM HEATING is MODERN, EFFICIENT and DEPENDABLE.

Sterlco Products Distributed through LEADING HEATING and PLUMBING WHOLESALERS

STERLING, INC.

5202 W. Clinton Ave., Milwaukee 18, Wis.

CONDENSATION AND VACUUM PUMPS

HEATING SPECIALTIES

TEMPERATURE CONTROLS

WHO'S WHAT...

(New personnel, promotions)

▸ *RUBEROID CO.*—E. J. O'Leary, president and chief executive officer; Stanley Woodward, vice chairman of the board; Frederick K. Sweeney, vice president in charge of sales; Kenneth R. MacDonald, vice president in charge of purchases.

▸ *AUER REGISTER CO.*—Charles C. Smith, president.

▸ *MILTON ROY CO.*—Paul Gibian, vice president of manufacturing.

▸ *COPELAND REFRIGERATION CORP.*—C. A. Lessing, chief engineer.

▸ *JAMES B. CLOW & SONS, INC.*—Thomas A. Ripley, vice president, elected to board of directors.

▸ *PHILIP CAREY MFG. CO.*—Paul D. Japp, vice president.

▸ *WATTS REGULATOR CO.*—Robert H. Chaffee, executive vice president in charge of sales.

▸ *CLEAVER-BROOKS CO.*—R. W. Pipkorn, chief engineer, boiler division; P. E. Buday, assistant chief engineer, boiler division.

▸ *OHIO INJECTOR CO.*—Dana M. Norton, vice president of industrial relations.

▸ *WORTHINGTON CORP.*—A. E. Carter, vice president of manufacturing.

▸ *OLIN MATHIESON CHEMICAL CORP.*—Derek Richardson, vice president of aluminum sales, metals division.

▸ *TUTHILL PUMP CO.*—Michael J. McCaughey, general sales manager.

▸ *UNION CARBIDE CHEMICALS CO.*—H. Robert Dobbelaer, fluorocarbons office manager.

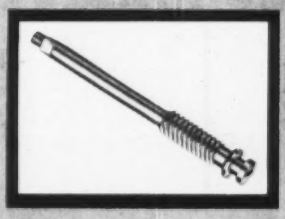
▸ *EDWIN L. WIEGAND CO.*—Pressly H. McCance, assistant to the president.

▸ *BELL & GOSSETT CO.*—Walter Kehm, field training instructor; Milton O. Larson, instructor in refrigeration and air conditioning in company's training and education department.

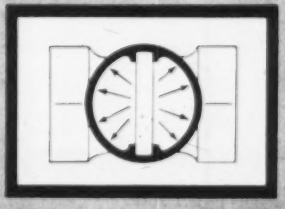
Here's How KENNEDY'S Design and Construction Features Give You Greater Value for Your Valve Dollar...

Fig. 525
125-Pound SWP Bronze Gate Valve
Union Bonnet · Rising Stem
Inside Screw · Wedge Disc

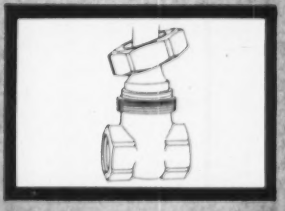
KENALLOY Stem . . . standard with Kennedy! Is strongly inhibited against dezincification and corrosion. It is a long-wearing metal for longer easier operation.



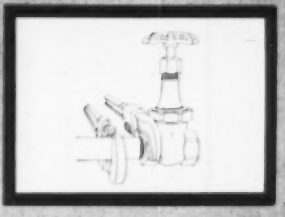
Cylindrical Body withstands sudden pressure. Kennedy's Cylindrical Body construction resists rupture and minimizes deflection when under severe pressure.



Heavy Bronze Union Bonnet Ring is entirely separate from the bonnet to eliminate any possibility of springing the bonnet face when assembling or disassembling the valve for cleaning or inspection.



The Kennedy wider hex ends are blended into body making the body and hexes one unit. This rugged construction prevents distortion and wrench pressure is absorbed.



These additional advantages make KENNEDY your best valve buy . .

Fig. 525 . . . newest in the valve field . . . best in the valve field. Fig. 525 gives greater strength with less bulk and weight than any comparably rated valve.

Kennedy's Fig. 525 can be repacked under pressure thus eliminating line shut-down. Simply open valve fully, remove packing nut and repack.

Threads in the KENALLOY Stem are accurately machined to eliminate feather edge ends which in ordinary valve stems break off and lock the stem in the bonnet. This accurate machining means easier operation and longer valve life.

The joint between the body and the bonnet is bronze-to-bronze true union. Generally accepted as the most satisfactory type of union joint.

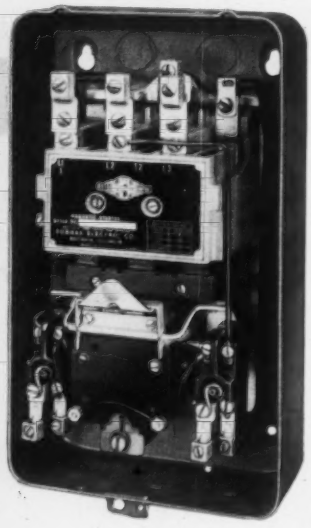
• *YOU CAN'T BUY A BETTER VALVE THEN A KENNEDY!*

KENNEDY VALVE MFG. CO.
1607 EAST WATER ST., ELMIRA, NEW YORK
VALVES • PIPE FITTINGS • FIRE HYDRANTS

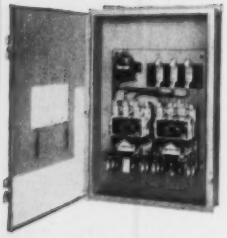
• OFFICES AND WAREHOUSES IN NEW YORK, CHICAGO, SEATTLE, SAN FRANCISCO, ATLANTA • SALES REPRESENTATIVES IN PRINCIPAL CITIES •

FURNAS ELECTRIC

CONTROLS HELP YOU REDUCE COST AND SPACE REQUIREMENTS

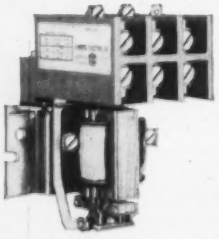


Magnetic Starters in 10 sizes to 100 hp. Furnas starters for control of high horsepower compressors offer the exclusive Furnas "in-between" size starters with dual voltage magnet coils.



Step or Cushion Starting permits the use of larger motors by limiting the inrush current on starting. These methods reduce or completely eliminate objectionable line disturbances due to full voltage across-the-line starting. Furnas Electric offers a complete line of Increment, Auto Transformer and Resistance-type Step Starters.

Furnas contactors feature 20, 24, 30, 35, 40, and 50 ampere sizes to match starter requirements. Silver cadmium oxide contacts for longer life. Floating armature insures quiet operation.



For full information write for Bulletin 5610, 1041 McKee St., Batavia, Ill.

A42

FURNAS ELECTRIC COMPANY

BATAVIA, ILLINOIS

SALES REPRESENTATIVES IN ALL PRINCIPAL CITIES

WHO'S WHAT

Continued

▸ *FOOD MACHINERY AND CHEMICAL CORP.*—Robert B. Brown, manager of market research for *PEERLESS PUMP DIV.*

▸ *GRAVER WATER CONDITIONING CO.*—George Apfel, process engineering manager; N. S. Chamberlin, chemical processing manager; J. D. Crell, foreign operations manager; Robert Dvorin, industrial waste treatment manager; E. A. Strahlendorff, industrial water treatment manager; R. S. Lewis, sales promotion.

▸ *NATIONAL-U. S. RADIATOR CORP.*—John Fussner, manager for finned surface sales of the heating and air conditioning division; William S. Patton, advertising production manager.

▸ *CHESTER CABLE CORP.*—Howard A. Utech, sales manager for electrical division.

▸ *WILLIAM WALLACE CO.*—Frank Kohles, general sales manager; Robert A. McHugh, assistant to the general sales manager; Walter S. Waddington, assistant sales manager.

▸ *JOHN WOOD CO.*—Walt S. Sepura, vice president and plant manager for *BENNETT PUMP DIV.*; Patrick N. Morgan, vice president of heater and tank division.

▸ *YORK DIV., BORG-WARNER CORP.*—Alwin B. Newton, director of engineering.

▸ *ELOF HANSSON, INC.*—Edwin S. Bishop, manager, engineering and research for acoustical division.

▸ *PAYNE CO.*—Orrin E. Burwell, managing director of product application and engineering department.

▸ *RHEEM MFG. CO.*—A. G. Handschumacher, corporate director of research and development.

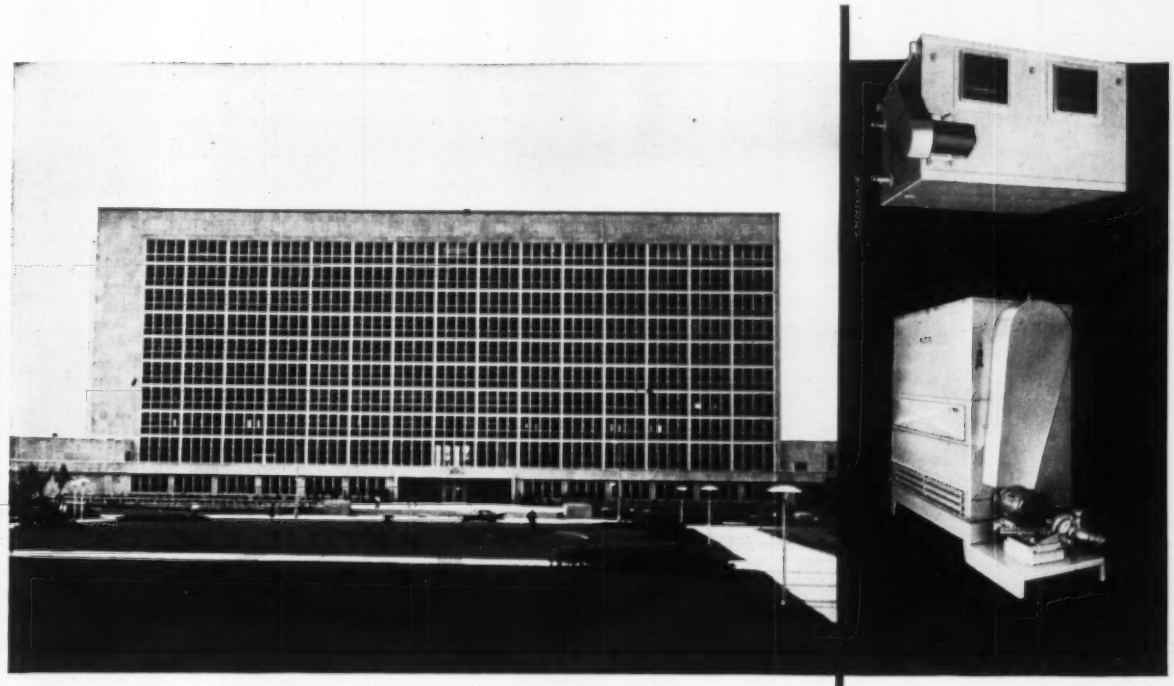
▸ *DAYTON RUBBER CO.*—Robert G. Burson, general sales manager of mechanical goods division.

▸ *EBCO MFG. CO.*—Richard J. Radcliffe, assistant chief engineer—product development and test.

▸ *AUSTIN CO.*—Theodore M. Pinney, district engineer of Cleveland district; Edmund W. Hollister, assistant manager of Cleveland district.

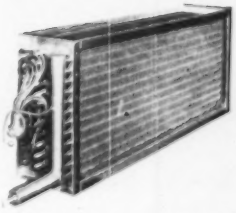
Marlo Air-Conditioning

equipment cools *New Orleans* modern city hall



In contrast to the Old World atmosphere of the French Quarter, this new crystal-and-concrete structure shows us another side of New Orleans—crisp and clean-lined, modern and functional.

But sweeping areas of glass like these demand an air conditioning system of flexibility and dependability. To meet these special needs, three types of Marlo equipment were installed: floor type central station units, coils and cooling tower. In the muggiest heat that New Orleans can muster, city hall workers and visitors stay fresh and unwilted.



This striking building was designed by Favrot, Reed, Mathes & Bergman. Engineers were De Laureal & Moses, mechanical contractor Emile M. Babst Co.

There's a Marlo representative near you. For complete information on modern Marlo air conditioning and heat transfer equipment, call him or write directly to us.

Marlo coil co.

SAINT LOUIS 11, MISSOURI

Quality Air Conditioning and Heat Transfer Equipment Since 1925

NEW DESIGNED, WIDER RANGE

DRAYER

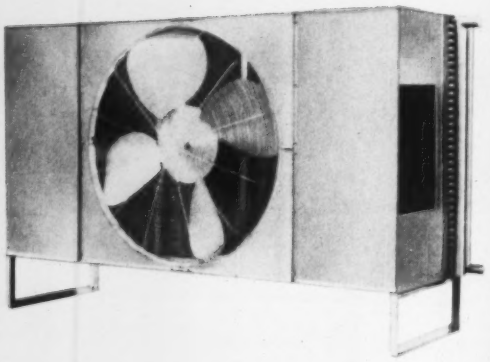
D-H AIR-COOLED CONDENSERS

HANSON

ALSO COME JOB-READY FOR

"ACC'S"

MULTI-CIRCUIT APPLICATIONS



STANDARD SELF-CONTAINED, REMOTE MODELS, 3 TO 25 TONS. RANGE UNLIMITED BY DUPLEXING. INDOOR-OUTDOOR REFRIGERATION OR AIR CONDITIONING JOBS! "DRAW-THRU" PRINCIPLE. TOTALLY ENCLOSED MOTORS. FANS, NAFM-RATED. FAN GUARDS HEAVY WIRE, 'N PLATED. ANGLE-IRON MOUNTING STAND. FEATURES GALORE, ASK US MORE.

d-h SINCE 1919

drayer-hanson

DIVISION OF NATIONAL U. S. RADIATOR CORP.

3301 MEDFORD STREET
LOS ANGELES 63, CALIFORNIA

CABLE: CLICONI LOS ANGELES

WHO'S WHAT

Continued

▸ *AMERICAN-STANDARD*—Caleb S. Taft, manager of *PLUMBING AND HEATING DIV.* plant in Buffalo, N.Y.

▸ *SWARTWOUT CO.*—R. E. Parshall, assistant sales manager for the ventilator division.

▸ *WM. STEINEN MFG. CO.*—Joseph J. Stocki, head of the advertising and sales promotion department.

▸ *THOR POWER TOOL CO.*—James A. Perham, chief product engineer of *SPEEDWAY MFG. CO.* division.

▸ *TURNER BRASS WORKS*—William L. Lindgren, plant manager; William L. Poust, assistant plant manager.

IN THE TERRITORIES . . .

(Recent sales appointments)

▸ *E. I. DuPONT de NEMOURS & CO.*— Aubrey E. Fulford, sales engineer, Kansas City territory; M. Brooks Jackson, Jacksonville, Fla., sales engineer; John K. Worthington, sales engineer for Syracuse territory; William W. Massengill, Roanoke, Va., sales engineer; Lawrence P. Hall, technical assistant to division's sales manager in St. Louis territory; Robert Wright, Jr., Chicago sales engineer; Glenn A. Piper, Jr., technical assistant to sales manager in Wilmington, Del., office.

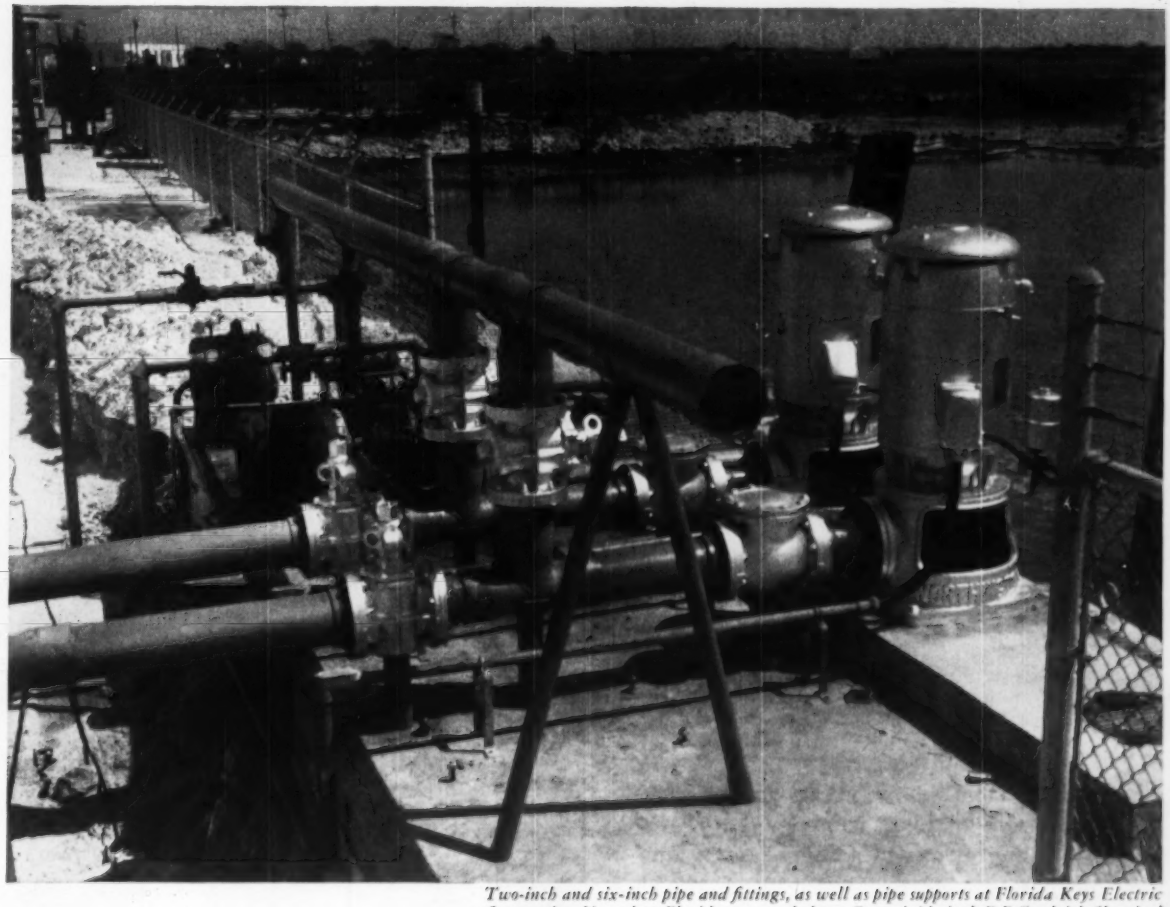
▸ *CENTURY ELECTRIC CO.*—Grant Hodgskiss, manager of Omaha office; W. D. Helm, manager of Chicago office; F. L. Bettie, acting district manager of Milwaukee branch office.

▸ *DUNHAM-BUSH, INC.*—John W. Tynan, sales engineer for heating products in Cincinnati area; Robert E. Luken, sales engineer for cooling products at Columbus, Ohio, with territory including Charleston and Huntington, W. Va.; H. E. Smith, sales engineer for cooling products in central New York; John P. Kilbane, application engineer, Cleveland; Robert W. Ramsey, application engineer, St. Louis; Hans Juergen Brenmoehl, application engineer, Los Angeles; Kenneth Kobs, heating products salesman; Thomas A. Naegli, application engineer for northeast district.

▸ *H. C. LITTLE BURNER CO., INC.*—Dale Blomquist, factory representative in Salt Lake City trading area; Ben T. Clark, factory representative in Denver and adjacent territories.

News about

B.F.Goodrich Chemical *raw materials*



Two-inch and six-inch pipe and fittings, as well as pipe supports at Florida Keys Electric Cooperative, Marathon, Florida, are made from Geon rigid vinyl. B.F.Goodrich Chemical Company supplies the rigid vinyl material only.

Pipe of Geon cures corrosion caused by ground currents

SEA water is used in the raw water system of this diesel generating plant, and electrolytic corrosion of the metal piping in the raw water system created quite a problem. Then pipe made from Geon rigid vinyl was installed and, after two years of operation, there is no corrosion problem in the piping handling the sea water.

The addition of a larger diesel unit to the plant now calls for six-inch pipe made from Geon rigid vinyl to handle the salt water used in cooling the diesels and lubricating oils, and for piping Bunker C fuel oil from the oil storage tanks to the plant. Even the pipe supports are made from Geon rigid vinyl.

Pipe of Geon is the logical choice wherever corrosion causes problems. And there are installation savings, too. Pipe of Geon is lightweight and easy to handle. Contractors like it. Can be readily joined by solvent welding or standard threaded fittings.

How can you benefit from pipe made of Geon rigid vinyl? Get information by writing Dept. LW-5, B.F. Goodrich Chemical Company, 3135 Euclid Avenue, Cleveland 15, Ohio. Cable address: Goodchemco. In Canada: Kitchener, Ontario.

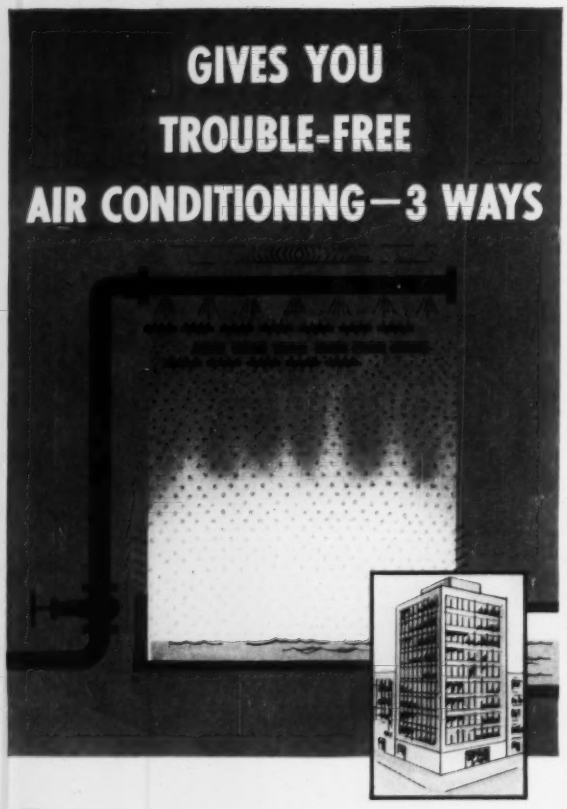
B. F. Goodrich Chemical Company
a division of The B.F.Goodrich Company

SEE US AT BOOTH NO. 509
8TH NATIONAL
PLASTICS
EXPOSITION
NOV. 17-21
INT'L AMPHITHEATRE-CHICAGO

B.F.Goodrich

GEON polyvinyl materials • HYCAR American rubber and latex
GOOD-RITE chemicals and plasticizers • HARMON colors

Oakite Airefiner No. 52 in water

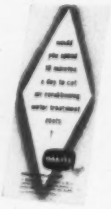


Properly treated water in air conditioning systems goes a long way in prolonging equipment life, improving operating efficiency and keeping systems trouble-free. A small amount of Oakite Airefiner No. 52 added to cooling tower water does all this—and more! A softening and purifying material, Airefiner No. 52:

1. **Checks growth of pipe-blocking, jet-clogging algae and slime**
2. **Prevents build-up of insulating scale**
3. **Minimizes metal-eating corrosion**

Try Oakite Airefiner No. 52 in your water system and see the difference in lower maintenance costs, more efficient cooling, less out-of-service time.

THIS MAINTENANCE MANUAL gives complete details on cleaning and maintaining air conditioning and refrigeration systems at less cost. For your free copy, write Oakite Products, Inc., 51B Rector Street, New York 6, N. Y.



SPECIALIZED INDUSTRIAL CLEANING
OAKITE
MATERIALS · METHODS · SERVICE
SCIENCE

In our 50th year

Export Division Cable Address: Oakite
Technical Service Representatives in Principal Cities of U. S. and Canada

WHO'S WHAT *Continued*

▸ *GRAVER WATER CONDITIONING CO.*—Crane Engineering Sales, Inc., Appleton, Wis., exclusive engineering representatives for most of Wisconsin and Upper Peninsula of Michigan.

▸ *CONTROLS CO. OF AMERICA*—Jack Shnable, West Coast general sales manager.

▸ *ILG ELECTRIC VENTILATING CO.*—John M. Dooley, sales representative for Knoxville, Tenn.

▸ *OVERHEAD HEATERS, INC.*—Art W. Pracker, middle eastern district manager with headquarters at Columbus, Ohio.

▸ *MIDCONTINENT TUBE SERVICE, INC.*—Clarence V. Zanin and Raymond Diadul, Chicago area sales and service representatives; Fred J. Reynolds Co., Davenport, Ia., representative for Iowa, Nebraska and the Quad-Cities; Brookes Engineering, Denver, representatives for Colorado, northern New Mexico and Wyoming.

▸ *NATIONAL-U.S. RADIATOR CORP.*—Roy O. Shelkey, manager of Detroit branch; William F. Hershey, manager of Cincinnati branch.

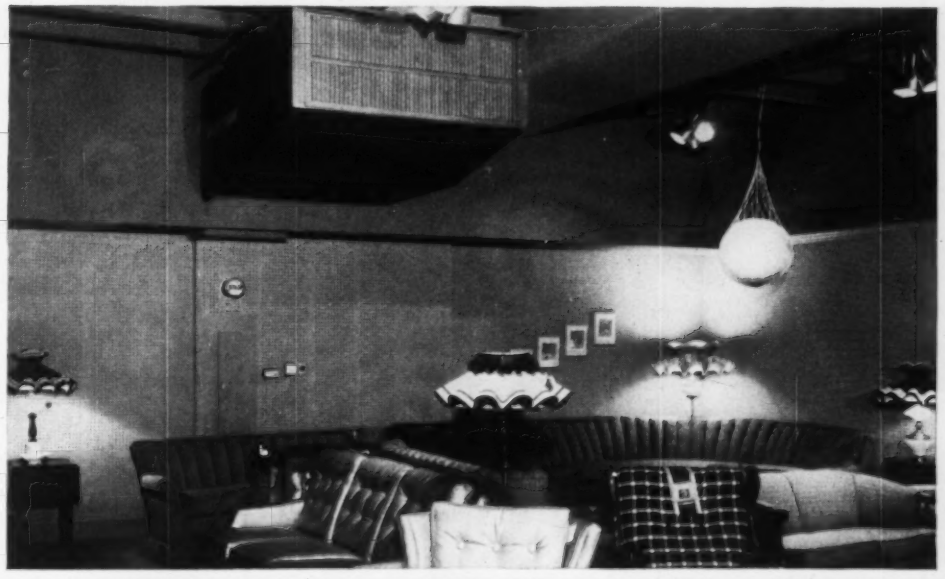
▸ *ACME INDUSTRIES, INC.*—William K. Parks, sales engineer in the Chicago area.

▸ *TRANE CO.*—J. H. Francis, manager of Canton, Ohio, sales office; Richard F. Ferris, sales engineer, New York; Kenneth J. Flaherty, salesman, Columbus, Ohio; Joseph A. Shea, Allentown, Pa., salesman; Robert D. Trebilcox, Milwaukee salesman. Sales engineers who have recently completed company's training program and their areas of assignment: Ralph D. Black, Clarksburg, W. Va.; Donald J. Brady, Buffalo, N.Y.; Richard W. Campbell, Seattle, Wash.; Ronnie E. Chamness, Dallas; George C. Drivas, Albany, N.Y.; Carl A. Lindbolm, Jr., La Crosse, Wis.; Gene B. Martin, Wichita, Kan.; Fred N. Reidenback, Newark, N.J.; James F. Sack, Grand Rapids, Mich.; John D. Vorel, Greenville, S.C.; Jack P. Watson, Denver, Colo.; J. Warner Whalen, West Hartford, Conn.

▸ *OLIN MATHIESON CHEMICAL CORP.*—North American Brass & Copper, Inc., Philadelphia, distributor in eastern Pennsylvania, Delaware, Maryland, District of Columbia, southern New Jersey and northern Virginia.

▸ *FAIRBANKS CO.*—Paul Franke, salesman, Long Island sales territory.

CASE #100—Another case where General Electric Factory-Assembled Air Conditioning Units proved more economical than field-assembled systems.



Architect: Harold A. Berry, A.I.A., Donald H. Speck, Associate—General Contractor: James C. Stewart Co.

General Electric Ceiling-Mounted Units at the Dallas Home Furnishings Mart take no floor space—provide individual temperature control (heat and cool)—are metered for zone control of operating cost.

General Electric Zone-by-Zone Air Conditioning in Dallas Home Furnishings Mart permits

INDIVIDUAL CONTROL OF TEMPERATURE—ZONE CONTROL OF OPERATING COST

Air conditioning the vast new Dallas Home Furnishings Mart presented a 3-way challenge. (1) Over 400,000 sq. ft. to be air conditioned. (2) Provision had to be made for each exhibitor to control his own temperature and operating cost. (3) Floor space was at a premium. The ideal solution was found—in the Zone-by-Zone installation of General Electric Ceiling-Mounted Units.

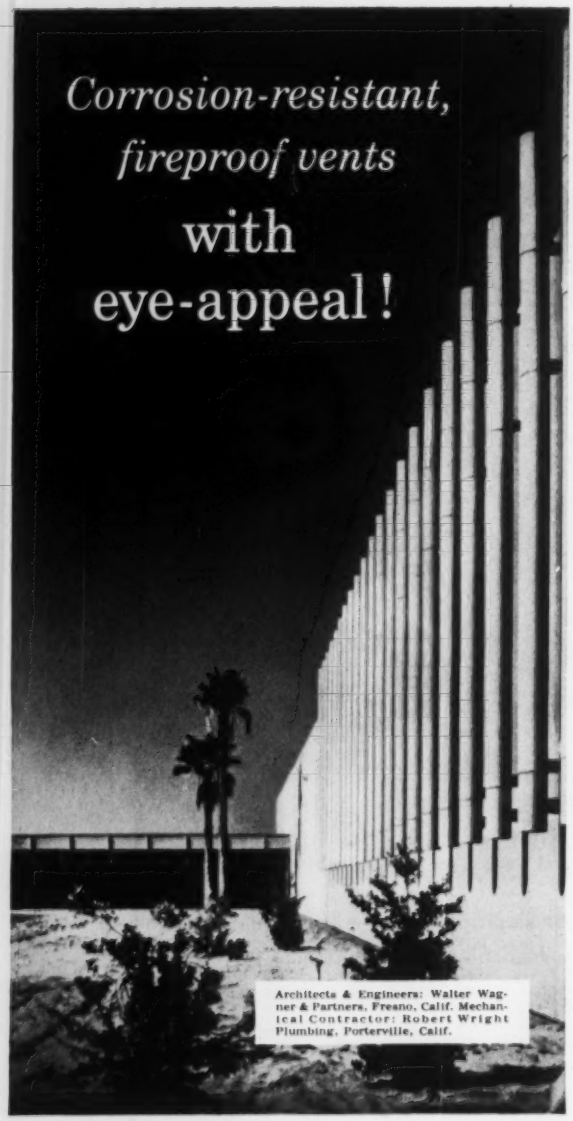
The entire area gets heating and cooling from the same units. Each exhibit area has its own units *individually controlled and metered. No floor space is used.* No ductwork is required. Noise is held to whisper level. And when the Mart proved so successful that Mr. Trammell Crow, owner, decided to double its size, all that was necessary was to add individual units as individual showrooms were added. No fuss—no alterations—no interference with performance of existing units. This is a typical example of how General Electric *factory-assembled* units meet the most exacting air conditioning requirements.

General Electric's complete line is flexible enough to meet every air conditioning requirement for all buildings—large or small—old or new. Ceiling-mounted units water-cooled up to 7½ tons—air-cooled up to 10 tons. Floor-mounted units—water-cooled up to 30 tons—air-cooled up to 20 tons. Steam and hot water coils available for all models. It will pay you to discover how General Electric Factory-Assembled Units can simplify your planning. For full details write: General Electric Company, Air Conditioning Department, Tyler, Texas.

Progress Is Our Most Important Product

GENERAL ELECTRIC

In Canada, Canadian General Electric Co., Ltd., Montreal


Corrosion-resistant,
fireproof vents
with
eye-appeal!
Architects & Engineers: Walter Wagner & Partners, Fresno, Calif. Mechanical Contractor: Robert Wright Plumbing, Porterville, Calif.

New plant at Porterville, Calif., has twenty-two 8" Transite exhaust flues.

Vertical exposed flues of Transite Vent Pipe form eye-catching design on new Rockwell Manufacturing Co. installation

A glance at this attractive new plant tells you that the material used for the exhaust flues is vital to the plant's appearance and maintenance economy. That's why Walter Wagner & Partners, Architects & Engineers, of Fresno, Calif., chose Transite Industrial Vent Pipe to exhaust corrosive fumes from the plant's small parts casting pots.

Made of asbestos-cement, Transite® retains its good appearance. Never needs painting or preservative coating. Resists the attack of most gases, mists, fumes, and dusts. Indoors or out, Transite offers you these same appearance and maintenance-free advantages. Let us send you DS-336—a 24-page brochure on Transite Industrial Vent Pipe. Write Johns-Manville, Box 14 HP, New York 16, N. Y. In Canada, Port Credit, Ontario.

JOHNS-MANVILLE
100 YEARS OF QUALITY PRODUCTS—1858-1958

WHO'S WHAT *Continued*

▸ *PRESSED STEEL TANK CO.*—R. P. Ricker, manager of Chicago district office; J. W. Flynn, New York district manager.

▸ *RECOLD CORP.*—Hugh D. Smart, refrigeration representative for Chicago area; Texas Refrigeration Supply Co., Fort Worth, distributor with branches in Waco, Lubbock and Odessa.

▸ *McQUAY, INC.*—Sweiger-Davidson Co., Chicago area representative.

▸ *SPENCE ENGINEERING CO., INC.*—R. C. Beckert Co., New York, sales representative in New York City and northern New Jersey.

▸ *CHASE BRASS & COPPER*—Arthur W. Schriewer, eastern regional stainless steel specialist with headquarters at Maspeth, L.I.

▸ *EMBASSY STEEL PRODUCTS*—Air Conditioning & Refrigerating Co., Inc., Anchorage, representative for State of Alaska.

▸ *AUTOMATIC SWITCH CO.*—Fitzpatrick Electric Supply Co., Muskegon, Traverse City, Holland, Mich.; John Day Rubber and Supply Co., Omaha; Electro-Tech Equipment Co. of Atlanta, Inc., Atlanta; Martin Electric Co., Dayton; W. A. Tydeman & Son, Inc., Bethlehem, Pa.; Mills & Lupton Supply Co., Chattanooga; Tristate Electrical Supply Co., Inc., Baltimore, Hagerstown, Cumberland, Md.; Ives Equipment Corp., Narbeth, Pa.; all authorized distributors of company's products.

▸ *PENN CONTROLS, INC.*—Decatur, Ga., district sales office moved to 1269 Amanda Circle.

▸ *GRAHAM MFG. CORP.*—New representatives for stud welding line: Wiley Welding Supply, Inc., Los Angeles, southern California representatives; William Corns, Ross, Calif., representative for northern California, Utah and Nevada; Thermo Tech Products Co., Denver, for Colorado, Wyoming, Arizona, New Mexico; Correll Engineering Co., St. Louis, territory broadened to include industrial accounts in Kansas City area; company has set up regional offices at 15 S. Austin Blvd., Chicago, and Tryon Bldg., Paramus, N.J.

▸ *TRION, INC.*—James R. Mason and Co., Charleston, W. Va., representative.

▸ *PECK, STOW & WILCOX CO.*—John C. Nowacki, Midwest representative. ≠

for greater strength . . . easier assembly

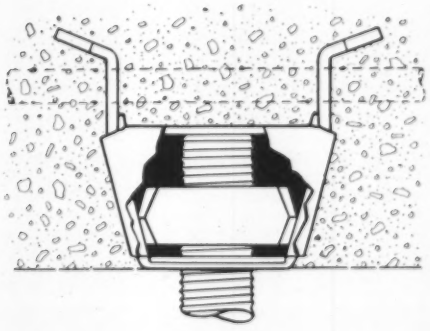
The new Grinnell Wedge Type Concrete Insert

Fig. 281

NEW design features give Grinnell's Wedge Type Concrete Insert (Fig. 281) greater load carrying capacity . . . 1200 lbs. for 5/8" and 3/4" sizes, with a safety factor of at least 5 to 1.

Heavy gauge steel is die-formed into a wedge-shaped box housing. When load is attached to the inserted nut and rod assembly, ends of the elongated nut press on the wedge-slanted walls.

These walls, acting in compression with the concrete, provide strength unmatched in steel inserts of equal size.



Preassembly of the elongated nut on the rod makes quick assembly possible.

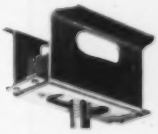
Installations can be made in quick time, too. Just a few turns of the rod tighten the nut rigidly in place. Slightly loosening the nut permits lateral adjustment along the full length of the slot, without fear of rod and nut falling out of the body.

Single body size accommodates four different interchangeable nut and rod sizes, to make ordering easier and installation simpler—especially where hanger rod sizes cannot be determined in advance of ceiling construction.

On your next project, specify Grinnell Concrete Inserts — either steel or malleable iron. Quality manufactured . . . *and priced right!* Grinnell Company, Inc., Providence 1, R. I.

CB-Universal Malleable Iron Concrete Insert (Fig. 282)

CB-Junior Malleable Iron Concrete Insert (Fig. 279)



Wrought Steel Concrete Insert (Fig. 280)

GRINNELL

PIPE HANGERS AND SUPPORTS

Grinnell Company, Inc., Providence, Rhode Island • Coast-to-Coast Network of Branch Warehouses and Distributors

pipe and tube fittings • welding fittings • engineered pipe hangers and supports • Thermolier unit heaters • valves
Grinnell-Saunders diaphragm valves • pipe • prefabricated piping • plumbing and heating specialties • water works supplies
industrial supplies • Grinnell automatic fire protection systems • Amco air conditioning systems

DeZURIK VALVES

give you more

at lower cost!

EASY OPERATION

DeZurik Valves open and close EASILY because the plug touches the valve body ONLY when the valve is closed. Pivoting the plug eccentrically means no binding, no scraping, no scoring.

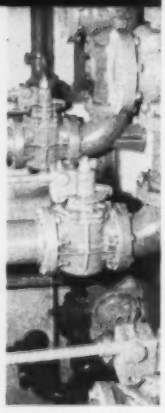
TIGHT SHUT-OFF

Dead-tight shut-off is guaranteed — every time — by the resilient facing on the plug of a DeZurik Valve. There's no chatter, no leaking, when you install DeZurik Valves.

WITH ECCENTRIC ACTION

NO MAINTENANCE

Because of their eccentric action and resilient-faced plugs, DeZurik Valves need no lubrication to provide easy operation and deliver tight shut-off. No guns or greases to stock, no lube schedule to maintain. And no stuffing box leakage to spoil decoration.



PERFECT FOR BALANCING

DeZurik Valves can be furnished with a pressure connection in the valve body and a removable handle for balancing service. They have low pressure loss, will not whine or chatter, have excellent throttling characteristics.

DeZurik Valves are available in sizes from ½" thru 20". See the DeZurik representative in your area or write for details.

DeZURIK CORPORATION
SARTELL, MINNESOTA

WE HEAR THAT...

▸ A new warehouse-service center to serve Columbus, Ohio, area industry has been established by *EUTECTIC WELDING ALLOYS, OHIO VALLEY DIV., INC.*

▸ *HOWARD INDUSTRIES, INC.* has acquired another motor line, completing the purchase of induction motors from *WESTINGHOUSE ELECTRIC CORP.*

▸ *AMERICAN AIR FILTER CO.* has begun its annual technical training program with 15 graduates from 12 colleges and universities. The physics of electricity, properties of dust, heat transfer, etc., will be studied with the design and application characteristics of all products manufactured and sold by the company and its subsidiaries.

▸ *BARRY BLOWER CO.* has made a 100 percent expansion in plant and other facilities this year and the company's national sales organization has also been increased. The company was also recently elected a member of *AIR MOVING AND CONDITIONING ASSOCIATION, INC.*

▸ Sixty sales representatives attended a two-day technical training school staged by *KENNARD CORP.* The sessions were directed by *BEN S. McDOUGALL*, sales manager of the company, and *C. A. PICKETT*, sales manager of the parent firm, *AMERICAN AIR FILTER CO.*

▸ *YOUNGSTOWN SHEET AND TUBE CO.* announced the expansion of its general sales and order departments in order to expedite entry, scheduling, shipment of product orders. A modernized and enlarged wire communication center has also been established, making it possible to teletype orders to plants for greater speed in handling.

▸ *ARKOS MFG. CO.* has been formed as the production division of *ARNOLD KOSARIN & ASSOCIATES* in Detroit to produce a new line of direct fired heaters.

▸ The expansion of *AIR REDUCTION SALES CO.'s* gaseous and liquid oxygen producing facilities at Lorain, Ohio, has been announced. Daily production capacity of the plant has been boosted from 40 to 100 tons per day.

▸ Open house marking the official opening of a new welding service center operated by *EUTECTIC WELDING ALLOYS CO. OF MICHIGAN* attracted an attendance of almost a thousand.

There is one simple way to connect appliance piping

Dresser® Compression Fittings are the easiest, fastest, safest and most reliable way of connecting home appliance piping or cutting into existing lines.

No elaborate equipment or preparation required for installation . . . no skinned knuckles or fumbling in tight quarters. A few turns of a simple hand wrench, and you've got a *permanent, leak-proof* joint. The special compound Dresser gasket absorbs vibration, helps prevent ensuing pipe failure.

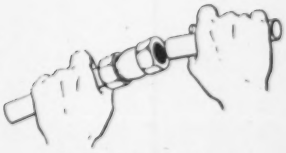
Dresser Compression Fittings eliminate pipe threading, flaring, grooving and exact cutting of pipe. They handle pipe deflection up to 6° *at each joint* and still provide an absolute seal. You can count on a perfect job every time with Dresser Fittings. Can you afford not to? Stock up at your local plumbing supply jobber.

SEND FOR ILLUSTRATED FOLDER SHOWING TYPICAL TIME-SAVING APPLICATIONS

DRESSER
MANUFACTURING DIVISION
ONE OF THE DRESSER INDUSTRIES

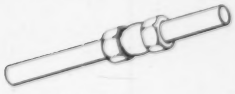
Bradford, Pennsylvania. Chicago • Houston
New York • Philadelphia • S. San Francisco • Toronto & Calgary

HOW–



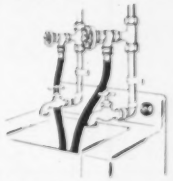
1. Stab pipe ends into factory assembled Dresser Fitting.

2. Tighten end nuts– takes only a few seconds.

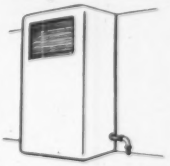


3. That's all! A permanently tight, flexible joint.

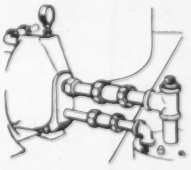
WHERE–



AUTOMATIC WASHERS– GAS DRYERS
Dresser Threaded Branch Tee eliminates expensive pipe fittings.



AIR CONDITIONERS
Fast connection of water and coolant piping.



HOME WATER PUMP–
No problems of vibration . . . the Dresser Coupling absorbs it.

AND MANY, MANY OTHERS!

WHY–

You save time and money, eliminate difficult operations and have the assurance of a job completed perfectly.

WE HEAR THAT

Continued

▶ *ROBBINS & MYERS, INC.* has purchased *TRADEWIND MOTOR FANS, INC.*, Pico Rivera, Calif.

▶ Construction of a new warehouse for *MIDCONTINENT TUBE SERVICE, INC.* has begun. The warehouse in Evanston, Ill., will be on company property covering over 1½ acres at the rear of the main building, and will face 600 ft of private railroad siding.

▶ *JOSEPH T. RYERSON & SON, INC.* has stepped up its aluminum service program at its Milwaukee plant. Aluminum stocks at the plant have been increased and sales personnel has been realigned.

▶ *CARRIER CORP.* has opened its new administration and research center at Syracuse, N. Y. The center is divided into three sections: an administration building, a research center and the services area. Office space comprises 29,000 sq ft. An additional 38,000 sq ft is provided for laboratory work on advanced research and development projects of many types. The services area has a total space of 50,000 sq ft. It includes a large reception lobby, an exhibit hall, an auditorium seating 550 people and a cafeteria to accommodate 348 people.

▶ *AIR REDUCTION SALES CO.* has announced plans for the construction of a new plant to supply pipeline oxygen to the *ARMCO STEEL CORP.* at Butler, Pa. The new plant will consist of an air separation unit with a production capacity of 120 tons per day and will pipe up to 84,000 cu ft of oxygen per month for metallurgical applications in the manufacture of steel and other general steel mill purposes.

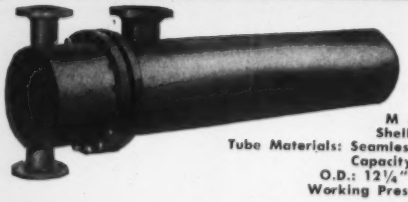
▶ The new million dollar *NATIONAL-U.S. RADIATOR CORP.* Engineering Center will be dedicated on October 16. The new facility has more than 40,000 sq ft of space and is situated on an 8 acre tract known as Research Park.

▶ *GAS APPLIANCE MANUFACTURERS ASSOCIATION* has established a new division this year for manufacturers of heavy-duty forced air heaters.

▶ The electric utility and coal industries are financing a research program to be undertaken in the laboratories of *BITUMINOUS RESEARCH, INC.* Two aspects of a problem involving the reduction of sulfur

MANNING & LEWIS ENGINEERING CO.
28-42 OGDEN ST. NEWARK 4, N.J.
WORKING PRESS.: SHELL TUBES
UNIT NO. JOB NO.

FUEL OIL HEATERS
WATER HEATERS
and COOLERS



M & L CONVERTER
Shell Material: Steel
Tube Materials: Seamless Drawn Copper
Capacity: 13,200 g.p.h.
O.D.: 12¼" Length: 106½"
Working Pressures: 150 P.S.I.

The above unit is one of several M & L Converters now installed at Idlewild Airport in New York. They were designed and fabricated to furnish the heating system of a hangar with water at 140°F.

In order to meet exact specifications, minor changes were made in standard M & L Converters and one more successful installation went into the record.

Our long proven ability to design for a specific need has been extremely helpful in thousands of successful installations all over the country. This service is as near to you as your telephone.

For further details send for your copy of bulletin 780, or we will be happy to send a representative to assist you with any heating or cooling problem.

Dept. D

THIS NAMEPLATE IS YOUR GUARANTEE OF QUALITY

Heat Exchangers
Condensate Coolers
Heating Elements
Converters
Tank Heaters
Tankless Water Heaters
Instantaneous Water Heaters

Manning & Lewis Engineering Company
DESIGNERS & MANUFACTURERS OF QUALITY HEAT EXCHANGE EQUIPMENT
28-42 OGDEN STREET NEWARK 4, NEW JERSEY

M.L

EXPECTING AN ORDER?

You'll get it quicker if your postal zone number is on the order blanks, return envelopes, letterheads.

The Post Office has divided 106 cities into postal delivery zones to speed mail delivery. Be sure to include zone number when writing to these cities; be sure to include *your* zone number in *your* return address—after the city, before the state.

Modernize your v-belt drives with

TAPER-LOCK SHEAVES

–proved in over a million installations!

- No flange. No collar. *It's different.*
- Easy on—easy off.
- Just tighten the screws that wedge the bushing. Simple, isn't it?
- Always a perfect fit on shaft—tight as "shrunk-on."
- Complete range of sizes. A, B, C and D grooves, in *stock.*
- Try it—and you'll standardize on it!

Taper-Lock Sheaves, with their precision machining, team up with matched Sealed-Life V-Belts to insure steady performance and unusually long belt life.

DODGE MANUFACTURING CORPORATION, 1600 Union St., Mishawaka, Ind.

CALL THE TRANSMISSIONEER—your local Dodge Distributor. Factory trained by Dodge, he can give you valuable help on new, cost-saving methods. Look in the *white* pages of your telephone directory for "Dodge Transmissioneer."

DODGE
of Mishawaka, Ind.

Above: View of a portion of 100-plus Aerovent "Model 53" Roof Ventilators installed on a West Coast auto assembly plant. Below: Closeup of a single Model 53 **"low-level"** unit. Standard and special-purpose units available in sizes 12" to 72" for capacities to 93,500 CFM. 3 types.

write for free Bulletin 600

Certified Ratings

Aerovent fans are rated in accordance with the standard test code for centrifugal and axial fans and conform with U.S.D.C. Comm. Std. CS178-51.

Aerovent

FAN COMPANY, INC.

ASH and BRANCH STS. • PIQUA, OHIO

Member Air-Moving and Conditioning Assn. (AMCA)

WE HEAR THAT

Continued

dioxide and other contaminants in flue gas as produced, and the reduction of sulfur in steam coals prior to burning will be attacked.

▸ *ROBERTSHAW-FULTON CONTROLS CO.* will build a $2½ million plant for the production of thermostatic control devices near Youngwood on the Pennsylvania Turnpike. The new facility will be ready for operation in about 18 months.

▸ *UNION CARBIDE CHEMICALS CO., Div. of UNION CARBIDE CORP.* will market a new fluorocarbon refrigerant. Production of 50 million lb per year will be centered at a new plant under construction at Institute, W. Va. It is scheduled to begin operation this fall.

▸ Quietness topped the items considered to be most important by 2000 consulting mechanical engineers when asked in a survey which of 13 listed points were of greatest importance in specifying electrical propeller fans, centrifugal fans, and blowers, according to *ILG ELECTRIC VENTILATING CO.* Quietness was followed closely by vibration-free operation and long life. Next came low maintenance cost, accessibility of parts for ease of repair, relative efficiency, and low operating cost.

The survey was followed with a contest asking prospects and customers to guess how the consulting engineers ranked the selection points in order of preference. The company received over 4000 entries. The top seven points mentioned were common to both groups. ⫩

Obituary

Theodore C. Fedders

THEODORE C. FEDDERS, last president of the Fedders Manufacturing Co., Inc., predecessor to Fedders-Quigan Corp., died in Buffalo on August 18 at the age of 64. Mr. Fedders was the youngest and last surviving of four sons of Theodore C. Fedders, Sr., founder of Fedders Manufacturing. He became president of the company in 1941 and remained in that post until 1945 when a merger was effected with the Frank J. Quigan Corp. to form the present corporation. He is survived by his wife, Mildred, a son, Gordon, a sister and three grandchildren.

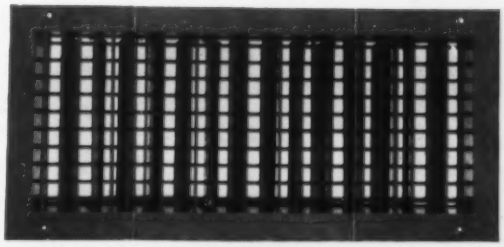
NOW AGITAIR® REGISTERS and GRILLES

(formerly STEWART)

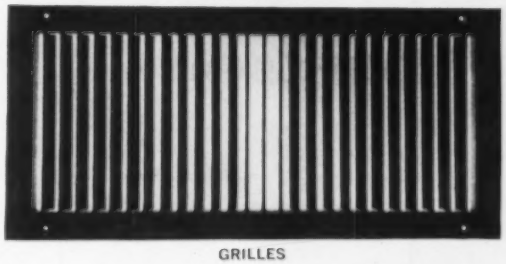
Air Devices Inc., has acquired the complete line of STEWART Registers and Grilles to add to job proven AGITAIR Diffusers, Filters and Exhausters...THERMOTANK High Velocity Mixing Boxes and Punkah Louvres.

Now from one source, Air Devices Inc., you can select with confidence and specify any AGITAIR product and be assured that the item or items selected will meet every performance and architectural requirement.

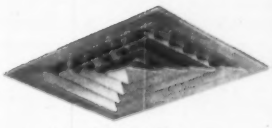
All Air Devices Inc. representatives have practical "on the job" experience in the application of Agitair products. They will gladly assist you in the selection, sizing and application of these products.



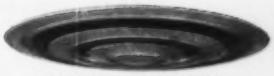
REGISTERS



GRILLES

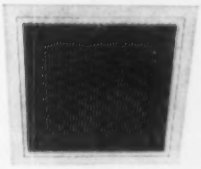


SQUARE & RECTANGULAR DIFFUSERS

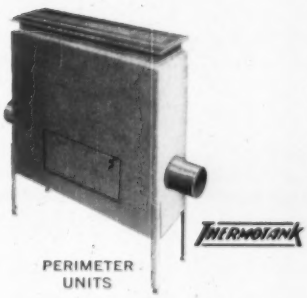


CIRCULAR DIFFUSERS

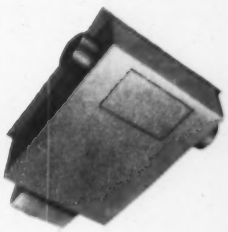
STRIPLINE DIFFUSERS



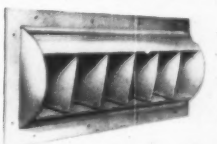
PERFAIR PERFORATED DIFFUSERS



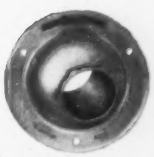
PERIMETER UNITS



CEILING UNITS

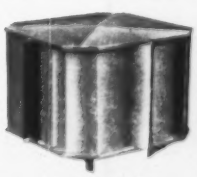


DRUM PUNKAH LOUVRES



ROUND PUNKAH LOUVRES

FILTERS



EXHAUSTERS

AIR DEVICES INC.

185 MADISON AVENUE, NEW YORK 16, N. Y.

high velocity units • punkah louvers
air diffusers • filters • exhausters
registers and grilles

"WITCH"

PIPE HANGERS

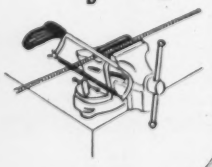
FOR

HEATING – PLUMBING
POWER & PROCESS

STOP WASTING MAN HOURS
USE PRE-THREADED HANGER ROD

FIG. 94 ALL THREAD ROD

SINGLE SAW CUT FABRICATES ANY HANGER ROD 1/4" THRU 7/8" DIA. UP TO 72" LONG



Our catalogue illustrates a complete line of Pipe Hangers & Supports and is an indispensable reference book for engineers, contractors, estimators & erectors. Write for your copy now.

MAINTAINING OFFICES AND WAREHOUSES ACROSS THE NATION

CARPENTER and PATERSON, Inc.

18 HURLEY ST., CAMBRIDGE, MASS.

MEETINGS & CONVENTIONS

1958

OCT. 12-15—*Refrigeration and Air Conditioning Contractors Association*, annual convention. Broadmoor Hotel, Colorado Springs, Colo. Refrigeration and Air Conditioning Contractors Association, 10660 Carnegie Ave., Cleveland 6.

OCT. 13-15—*American Gas Association*, annual convention. Atlantic City. AGA headquarters: 420 Lexington Ave., New York 17.

OCT. 16-17—*Pressure-Pipe and Pressure-Vessel Welding*, seminar conducted by the College of Engineering of the University of Wisconsin Extension Div. and the Madison section of the American Welding Society. Information: College of Engineering, University of Wisconsin Extension Div., Madison, Wis.

OCT. 25—*Plumbing-Heating-Cooling Information Bureau*, meeting. Plumbing-Heating-Cooling-Information Bureau, 35 E. Wacker Dr., Chicago 1.

OCT. 20-24—*National Safety Congress*, 46th annual convention. Conrad Hilton Hotel, Chicago. National Safety Council, 425 N. Michigan Ave., Chicago 11.

NOV. 11-13—*National Association of Practical Refrigerating Engineers, Inc.*, annual meeting. Kenilworth Hotel, Miami Beach, Fla. National Association of Practical Refrigerating Engineers, Inc., 435 N. Waller Ave., Chicago 44.

NOV. 17-21—*Society of the Plastics Industry, Inc.*, eighth National Plastics Exposition. International Amphitheater, Chicago. To be held concurrently with the SPI annual national conference, Morrison Hotel, Chicago. SPI headquarters: 250 Park Ave., New York.

NOV. 18-20—*National Conference on Air Pollution*, Sheraton Park Hotel, Washington, D.C. Information: U.S. Public Health Dept., Washington, D.C.

NOV. 18-20—*American Standards Association*, meeting. Roosevelt Hotel, New York. American Standards Association, 70 E. 45th St., New York.

DEC. 1—*American Society of Heating and Air-Conditioning Engineers*, special meeting. Conrad-Hilton

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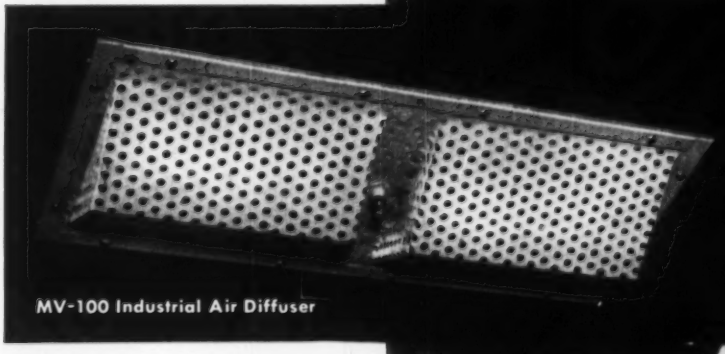

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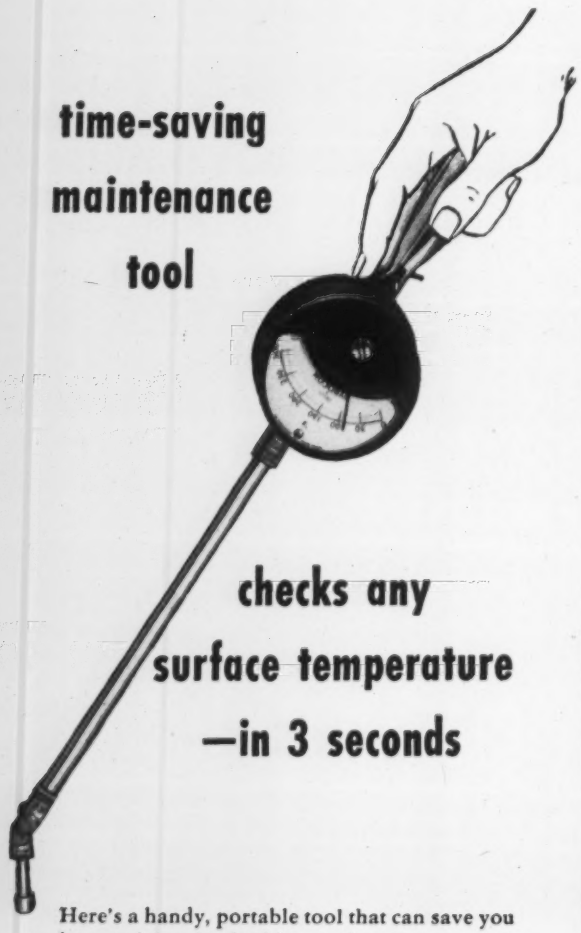

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MEETINGS & CONVENTIONS

Continued

1958

Hotel, Chicago. ASHAE headquarters: 62 Worth St., New York 13.

DEC. 1-3—*American Society of Refrigerating Engineers*, semi-annual meeting. Roosevelt Hotel, New Orleans, La. American Society of Refrigerating Engineers, 234 Fifth Ave., New York 1.

DEC. 1-4—*National Warm Air Heating and Air Conditioning Association*, annual convention. Cleveland, Ohio. Information: 640 Engineers Bldg., Cleveland 14.

DEC. 3-4—*Building Research Institute*, special meeting on field applied paints and protective coatings. Building Research Institute, National Academy of Sciences National Research Council, 2101 Constitution Ave., Washington 25, D. C.

DEC. 1-5—*American Society of Mechanical Engineers*, national exposition of power and mechanical engineering. New York Coliseum, New York. Information: International Exposition Co., 480 Lexington Ave., New York 17.

1959

JAN. 19-20—*Industrial Heating Equipment Association, Inc.*, meeting. Cleveland, Ohio. IHEA headquarters: 1145 19th, N.W., Washington 6, D. C.

JAN. 26-29—*Plant Maintenance and Engineering Show and Conference.* Cleveland Public Auditorium, Cleveland, Ohio. For information, contact: Clapp & Poliak, Inc., 341 Madison Ave., New York 17.

JAN. 26-29—*14th International Heating and Air-Conditioning Exposition.* Philadelphia. Under auspices of the American Society of Heating and Air-Conditioning Engineers, in conjunction with its 65th annual meeting, also in Philadelphia. Exposition management: International Exposition Co., 480 Lexington Ave., New York 17. ASHAE headquarters: 62 Worth St., New York 13.

FEB. 3-5—*Society of the Plastics Industry, Inc.*, 14th SPI reinforced plastics division conference. Edgewater Beach Hotel, Chicago. SPI headquarters: 250 Park Ave., New York 17.

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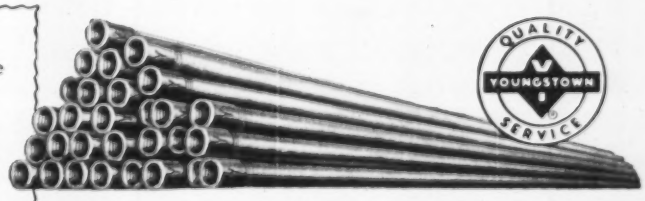

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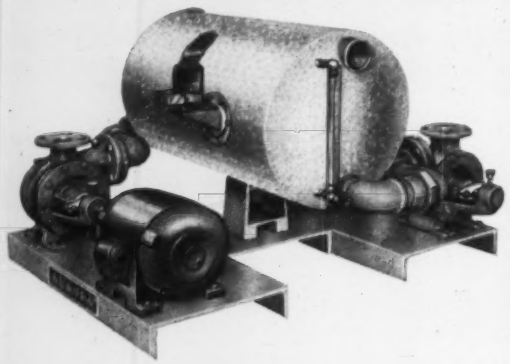

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MEETINGS & CONVENTIONS *Continued*

1959

MAR. 16-20—*National Association of Corrosion Engineers,* 1959 Corrosion Show and 15th annual conference. Sherman Hotel, Chicago. National Association of Corrosion Engineers, 1061 M & M Bldg., Houston 2.

APRIL 1-3—*Gas Appliance Manufacturers Association,* annual meeting. The Greenbrier, White Sulphur Springs, W. Va. GAMA headquarters: 60 E. 42nd St., New York 17.

APRIL 5-9—*Nuclear Congress.* Cleveland Auditorium, Cleveland. Information: Engineers Joint Council, 29 W. 39th St., New York 18.

APRIL 29-*MAY* 4—*Oil-Heat Institute of America, Inc.,* annual convention. Seattle, Wash., Oil-Heat Institute of America, Inc., 500 Fifth Ave., New York 36.

MAY 17-20—*Industrial Heating Equipment Association,* meeting. The Homestead, Hot Springs, Va. Industrial Heating Equipment Association, Inc., 1145 19th, N. W., Washington 6, D. C.

MAY 25-29—*National Fire Protection Association,* annual meeting. Atlantic City, New Jersey. National Fire Protection Association, 60 Batterymarch St., Boston.

JUNE 7-11—*American Society of Heating and Air-Conditioning Engineers,* semi-annual meeting. Vancouver, B. C., Can. ASHAE Headquarters: 60 Worth St., New York 13.

JUNE 21-26—*American Society for Testing Materials,* annual meeting. Chalfonte-Haddon Hall, Atlantic City, N. J. ASME headquarters: 1916 Race St., Philadelphia 3.

JUNE 22-24—*American Society of Refrigerating Engineers,* annual meeting. Lake Placid Club, Lake Placid, New York. ASRE headquarters: 234 Fifth Ave., New York 1.

SEPT. 21-25—*Instrument Society of America,* instrument-automation conference and exhibit. International Amphitheater, Chicago. For information contact: Fred J. Tabery, Exhibit. Manager, Instrument-Automation Conference and Exhibit, 3443 S. Hill St., Los Angeles 7. ‡

NEW BOOKS & REPORTS...

REFRIGERATION AND AIR CONDITIONING—By W. F. Stoecker. 397 pp. McGraw-Hill Book Co., Inc., 330 W. 42nd St., New York 36. $8.00.

WELDING HANDBOOK, GAS, ARC & RESISTANCE WELDING PROCESSES, SECTION II—Fourth Edition. American Welding Society, 33 W. 39th St., New York 18. $9.00.

ENGINEERING CONSULTANTS—Directory of the American Institute of Consulting Engineers. American Institute of Consulting Engineers, 33 W. 39th St., New York 18. $2.50 cloth-bound; $1.50 paper-bound.

REPORT OF THE UNITED NATIONS SCIENTIFIC COMMITTEE ON THE EFFECTS OF ATOMIC RADIATION—232 pp. United Nations, Office of Public Information, Press and Publications Div., United Nations, N. Y. $2.50.

STANDARDS OF THE EXPANSION JOINT MANUFACTURERS ASSOCIATION—31 pp. Expansion Joint Manufacturers Association, 53 Park Pl., New York 7. $1.00.

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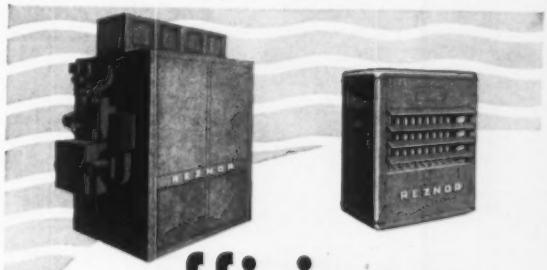

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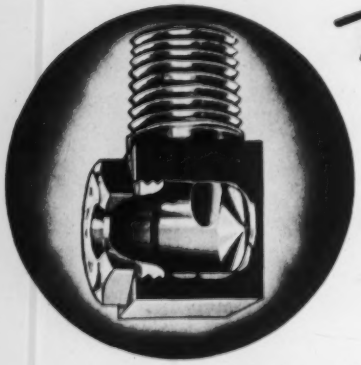

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NEW BOOKS & REPORTS

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SCHOOLHOUSE, Simon and Schuster, New York, N.Y.—$10.00. This is a primer about the building of the American public school plant produced jointly by Aluminum Company of America, Pittsburgh, Pa., Eggers and Higgins, architects, and Walter McQuade. Slocum & Fuller, consulting mechanical engineers, provided consultation on the heating and ventilation discussion. Included are cost comparisons for installation and operation for a 20 year period and evaluations of all types of heating systems for schools in tabular form. Also included are cost comparisons of various types of construction for schools.

LIQUID-LINE DRIERS—ARI Standard 710 Revised. Air-Conditioning and Refrigeration Institute, 1346 Connecticut Ave., N. W., Washington 6, D. C. 50c.

ANODIC COATINGS,—1934-58—CTR-348. Office of Technical Services, U. S. Department of Commerce, Washington 25, D. C. 10c.

FORCED CIRCULATION AIR-COOLING UNITS—ARI Standard 410 Revised. Air-Conditioning and Refrigeration Institute, 1346 Connecticut Ave., N. W., Washington 6, D. C.

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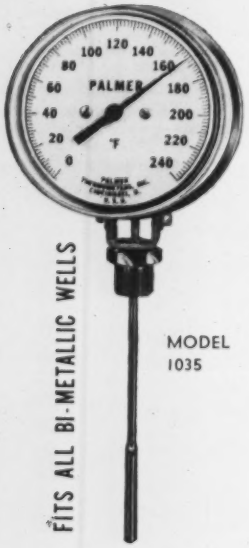

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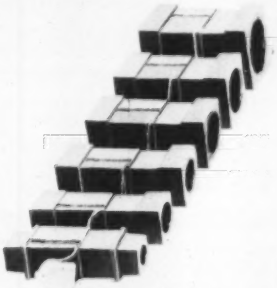
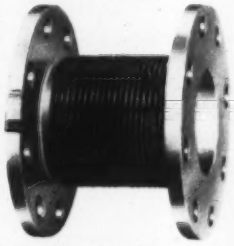


7 Q QUADRA-SIDE EXPANSION COMPENSATORS



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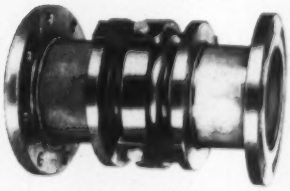
8-14S EXPANSION JOINT



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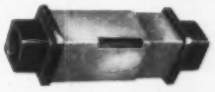

SIZES:
¾"—3.00" Inc.

TYPE 7Q
All Non Corrosive Stainless Steel Bellows
With Brass or Bronze End Fittings
and Telescopic Shrouds.
Details in Bulletin KQ-1
Standard Units—Pressure 300 psi Temp. 800 F.
Compression Force Less than 100 lb.

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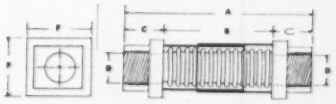

For: 1.50 in. Axial Travel

D Nom. IPS	A Overall Length	B Live Length	C Coup. Len.	F Max OD
¾–1.00–1.25"	6.50"	4.00"	1.25"	2.00"
1.50	6.50	4.00	1.25	2.50
2.00	6.50	4.00	1.25	3.00
2.50	6.50	4.00	1.25	3.50
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KEFLEX 7Q FINTUBE Assembly

KEFLEX 7Q With Anchor Base

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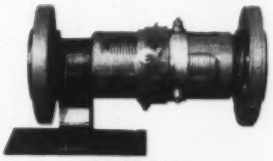

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With
KETROL GUIDES
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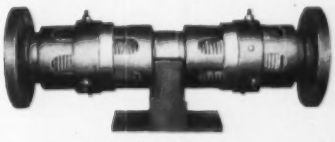

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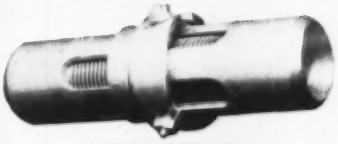

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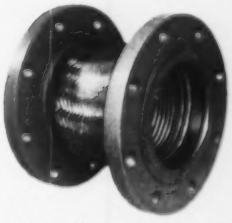

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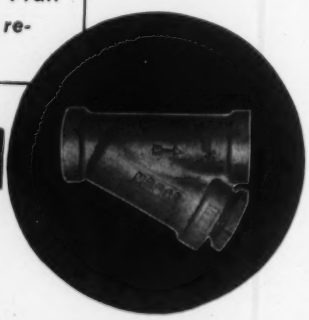

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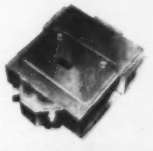

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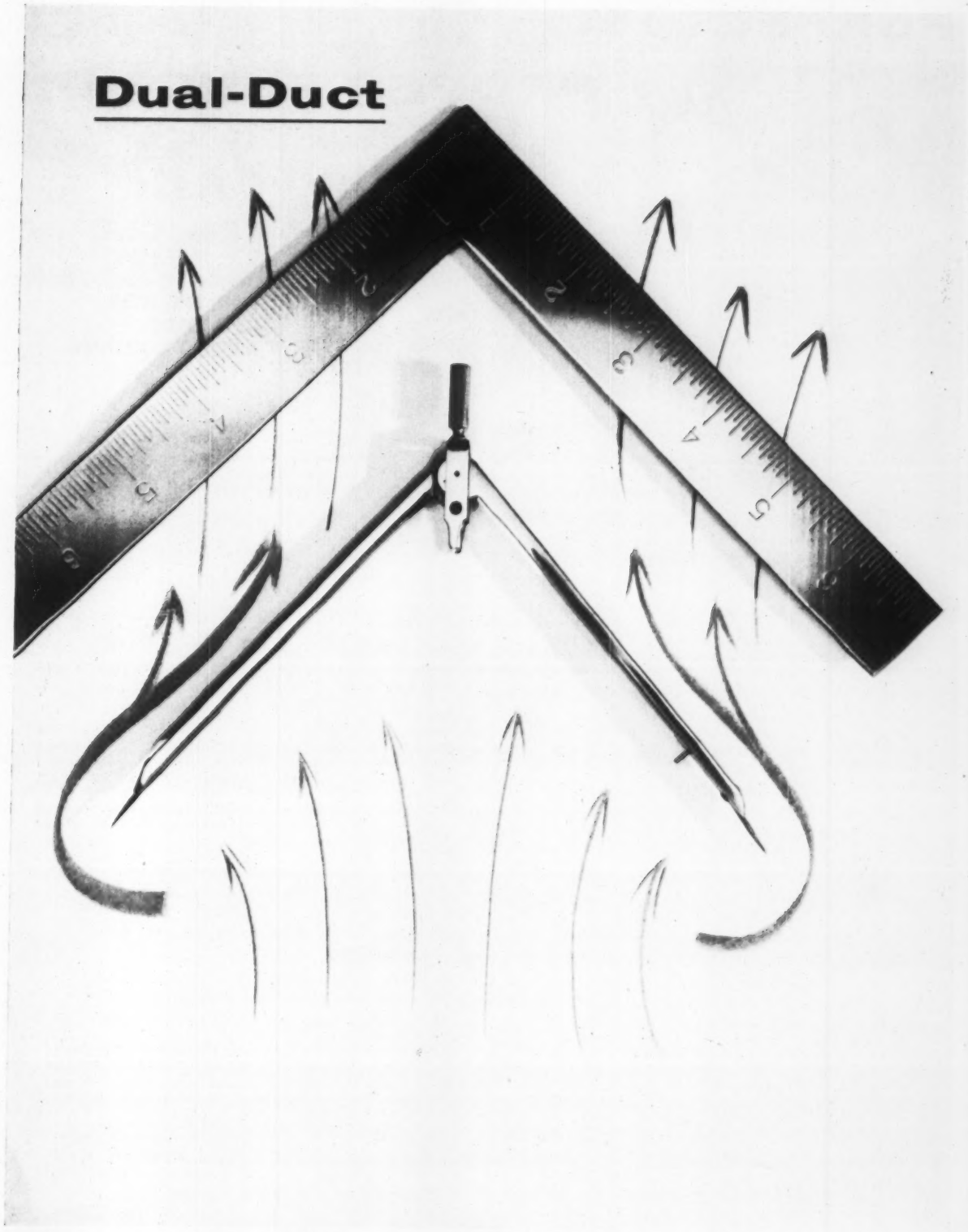
SIM in air



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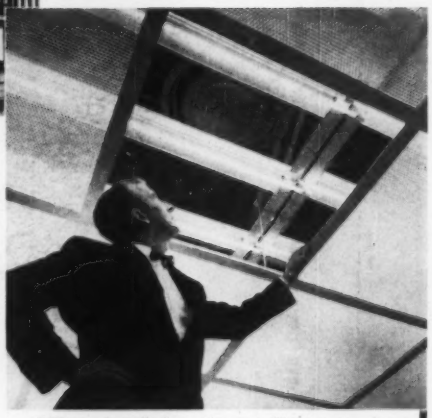

Diffuser installation above ceiling is an engineering accomplishment previously believed unworkable.

Pre-installation tests conducted at Connor's laboratory proved conclusively that the high degree of air entrainment produced by the Kno-Draft single stream diffuser satisfactorily would move air upward through the grid ceiling, where it would mix thoroughly with the supply air, and provide the areas below with constant, highly efficient air conditioning. And since installation, the equipment has been serving the Reynolds building to complete satisfaction.

Contact Connor for recommendations on your air distribution problems . . . common or uncommon. Our research and long practical experience guarantees you constant comfort conditions.

In grid ceiling areas, diffusers and return registers are entirely hidden.

In the plastered ceiling cafeteria, black, rounded contour units conform with the decor.

A standard Kno-Draft diffuser in an office area.

In other areas, linear diffusers, virtually unnoticeable from below, are mounted along the wall.

The above ceiling diffusers and the specially designed round and slotted units perfectly fulfilled stylistic requirements.
And not unexpectedly, Connor equipment is of all-aluminum construction.

CONNOR ENGINEERING CORPORATION

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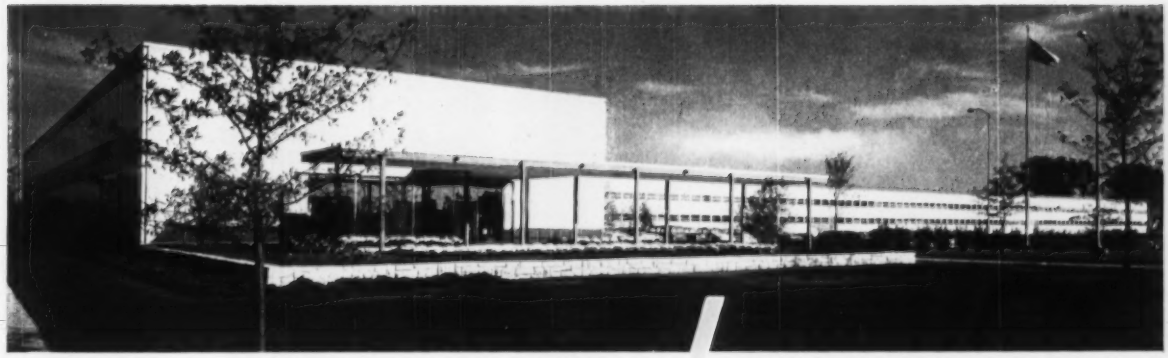
kno·draft®

high velocity air diffusers



ARCHITECTS and ENGINEERS: Skidmore, Owings & Merrill
GENERAL CONTRACTORS: Chell and Anderson
HEATING and PROCESS PIPING: Wm. A. Pope Co.
AIR CONDITIONING and VENTILATION: Cicero Sheet Metal Co.

Efficient Manufacture Employee Well-being

both aided by Clarage "air" in new Avon cosmetics plant

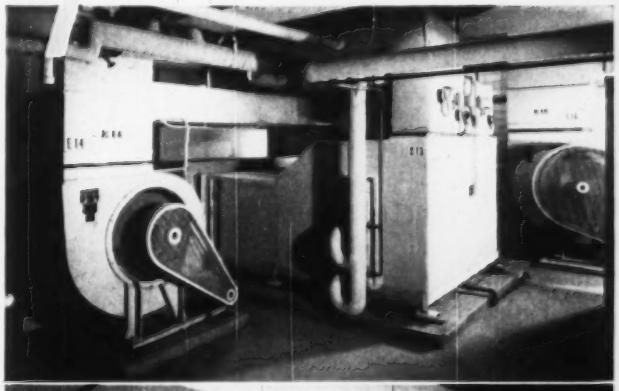
Here is much more than a thoroughly modern manufacturing facility. Here is a national sales center as well.

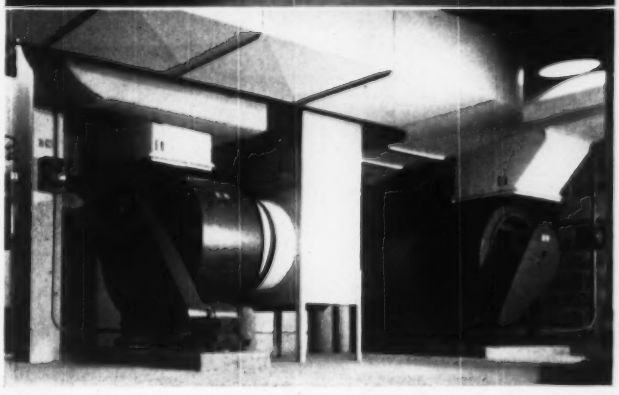
It's the new Avon Products, Inc., plant at Morton Grove, Illinois. From it flow the widely popular Avon cosmetic products. To it come members of Avon's door-to-door sales organization for training and sales meetings.

Air conditioning, thus, has a dual role to play in this structure – for employee comfort and for efficient manufacturing processes.

As for so many other noteworthy buildings, Clarage equipment was selected – some of which is shown on the right. On the job are Clarage Ready Unit ventilating sets, system fans, and Multitherm air conditioning units, including the famous Blow-Thru units pioneered and perfected by Clarage for multi-zone service.

You, too, will find it profitable to specify Clarage for your next assignments – no matter how large, how small. CLARAGE FAN COMPANY, Kalamazoo, Michigan.





CLARAGE

. . . dependable equipment for making air your servant

SALES ENGINEERING OFFICES IN ALL PRINCIPAL CITIES • IN CANADA: Canada Fans, Ltd., 4285 Richelieu St., Montreal

The family has grown!

. . . in size . . . in importance

The addition of a new and finer McDonnell 2-inch valve rounds out a line of safety relief valves for hot water space heating boilers that fulfills a vital need supremely well.

To know how true this is go back over the modern history of relief valves. With the rapid increase in closed systems, casualty companies, the National Board, and others concerned with boiler and heater safety went to work . . . and the net result was today's commendable A.S.M.E. Boiler Code calling for certified Btu-rated relief valves.

Closely following this work, McDonnell & Miller developed the first of all Btu-rated relief valves. They were not only first into the field; they are still first. They not only conform to the letter of the code; they go beyond this: *introduce new standards of their own.*

For Hot Water Space Heating Boilers

McDonnell Valve No.	Boiler Size Btu./hr.	Opening Pressure	Inlet	Outlet
230-¾ IN.-30	303,000	30 lbs.	¾"	¾"
240-¾ IN.-30	513,000	30 lbs.	¾"	1"
230-1 IN.-30	743,400	30 lbs.	1"	1"
240-1 IN.-30	910,000	30 lbs.	1"	1¼"
230-1½ IN.-30	1,025,100	30 lbs.	1½"	1½"
240-1½ IN.-30	1,560,000	30 lbs.	1½"	2"
240M-3	2,313,000	30 lbs. 36 lbs.	2"	1" 2"
240M-4	2,710,000	30 lbs. 36 lbs.	2"	1¼" 2"
240-2 IN.-30*	3,130,000	30 lbs.	2"	2½"
240-2 IN.-36*	3,550,000	36 lbs.	2"	2½"

*Recommended installation: 36 lb. opening valve, with smaller auxiliary valve set at 30 lbs. for thermal expansion.

New Bulletin P-33 gives up-to-the-minute facts

- A new bulletin shows why and how the entire rated capacity of McDonnell Relief Valves is obtained without diaphragms or other auxiliary lifting devices.
- It shows how this operation—this operation so basic to safety—is ideally accomplished by using specially calibrated "low rate" springs, matched to disc area to give smooth precise lift and tight closure.
- It explains the widely adopted McDonnell principle of progressive settings that keeps discharge in step with function . . . small valve relieving normal expansion; large stand-by valve ready for the emergency.

These and many more significant facts are covered in the bulletin. Note the accompanying table listing a valve for practically every boiler—McDonnell quality straight across the board.

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